# Configuring IP Services

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Bay Networks *Where Information Flows.™*

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# Preface

This guide describes IP services and what you do to start and customize IP services on a Bay Networks® router.

You can use the Bay Command Console (BCC™) or Site Manager to configure IP services on a router. In this guide, you will find instructions for using both the BCC and Site Manager.

## Before You Begin

Before using this guide, you must complete the following procedures. For a new router:

- Install the router (see the installation guide that came with your router).
- Connect the router to the network and create a pilot configuration file (see *Quick-Starting Routers*, *Configuring BayStack Remote Access*, or *Connecting ASN Routers to a Network)*.

Make sure that you are running the latest version of Bay Networks BayRS™ and Site Manager software. For information about upgrading BayRS and Site Manager, see the upgrading guide for your version of BayRS.

# Text Conventions

This guide uses the following text conventions:

| | |
|---|---|
| angle brackets (< >) | Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command.<br>Example: If the command syntax is:<br>**ping** <*ip_address*>, you enter:<br>**ping 192.32.10.12** |
| **bold text** | Indicates command names and options and text that you need to enter.<br>Example: Enter **show ip** {**alerts** \| **routes**}.<br>Example: Use the **dinfo** command. |
| braces ({}) | Indicate required elements in syntax descriptions where there is more than one option. You must choose only one of the options. Do not type the braces when entering the command.<br>Example: If the command syntax is:<br>**show ip** {**alerts** \| **routes**}, you must enter either:<br>**show ip alerts** or **show ip routes**, but not both. |
| brackets ([ ]) | Indicate optional elements in syntax descriptions. Do not type the brackets when entering the command.<br>Example: If the command syntax is:<br>**show ip interfaces** [**-alerts**], you can enter either:<br>**show ip interfaces** or **show ip interfaces -alerts**. |
| ellipsis points (. . . ) | Indicate that you repeat the last element of the command as needed.<br>Example: If the command syntax is:<br>**ethernet/2/1** [<*parameter*> <*value*>] **. . .** , you enter **ethernet/2/1** and as many parameter-value pairs as needed. |

| | |
|---|---|
| *italic text* | Indicates file and directory names, new terms, book titles, and variables in command syntax descriptions. Where a variable is two or more words, the words are connected by an underscore.<br><br>Example: If the command syntax is:<br>**show at** <*valid_route*><br>*valid_route* is one variable and you substitute one value for it. |
| `screen text` | Indicates system output, for example, prompts and system messages.<br><br>Example: `Set Bay Networks Trap Monitor Filters` |
| separator ( > ) | Shows menu paths.<br><br>Example: Protocols > IP identifies the IP option on the Protocols menu. |
| vertical line ( \| ) | Separates choices for command keywords and arguments. Enter only one of the choices. Do not type the vertical line when entering the command.<br><br>Example: If the command syntax is:<br>**show ip** {**alerts** \| **routes**}, you enter either:<br>**show ip alerts** or **show ip routes**, but not both. |

## Acronyms

This guide uses the following acronyms:

| | |
|---|---|
| AS | autonomous system |
| ASBR | AS boundary router |
| BR | border router |
| DVMRP | Distance Vector Multicast Routing Protocol |
| FDDI | Fiber Distributed Data Interface |
| HSSI | High Speed Serial Interface |
| IGMP | Internet Group Management Protocol |

| | |
|---|---|
| IGMP-R | IGMP Relay |
| IP | Internet Protocol |
| IR | internal router |
| LRM | Line Resource Manager |
| LSA | link state advertisement |
| MCT1 | multichannel T1 |
| MOSPF | multicasting extensions to OSPF |
| MTM | Multicast Table Manager |
| OSPF | Open Shortest Path First |
| PPP | Point-to-Point Protocol |
| QoS | quality of service |
| QOSPF | quality of service extensions to OSPF |
| RFC | Request for Comments |
| RIP | Routing Information Protocol |
| RSVP | Resource Reservation Protocol |
| TTL | time to live |
| UDP | User Datagram Protocol |

## Bay Networks Technical Publications

You can now print Bay Networks technical manuals and release notes free, directly from the Internet. Go to *support.baynetworks.com/library/tpubs/*. Find the Bay Networks product for which you need documentation. Then locate the specific category and model or version for your hardware or software product. Using Adobe Acrobat Reader, you can open the manuals and release notes, search for the sections you need, and print them on most standard printers. You can download Acrobat Reader free from the Adobe Systems Web site, *www.adobe.com*.

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- The “CD ROMs” section lists available CDs.
- The “Guides/Books” section lists books on technical topics.
- The “Technical Manuals” section lists available printed documentation sets.

Make a note of the part numbers and prices of the items that you want to order. Use the “Marketing Collateral Catalog description” link to place an order and to print the order form.

## How to Get Help

For product assistance, support contracts, information about educational services, and the telephone numbers of our global support offices, go to the following URL:

*http://www.baynetworks.com/corporate/contacts/*

In the United States and Canada, you can dial 800-2LANWAN for assistance.

# Chapter 1
# IP Concepts, Terminology, and Features

The following topics introduce concepts and terminology used in this manual:


| Topic | Page |
|---|---|
| IP Addresses | 1-2 |
| Autonomous Systems | 1-8 |
| Routing Information Protocol (RIP) | 1-9 |
| Open Shortest Path First (OSPF) Protocol | 1-10 |
| Border Gateway Protocol (BGP) | 1-10 |
| Exterior Gateway Protocol (EGP) | 1-10 |
| Router Discovery Protocol | 1-11 |
| Route Preferences | 1-12 |
| Route Weights | 1-13 |
| IP Routing Policies and Filters | 1-14 |
| IP Traffic Filters | 1-18 |
| RFC Compliance | 1-18 |

# IP Addresses

An IP address consists of 32 bits that have the form *network.host*. The *network* portion is a network number ranging from 8 to 24 bits. The *host* portion is the remaining 8 to 24 bits identifying a specific host on the network. The Internet Network Information Center (NIC) assigns the network portion of the IP address. Your network administrator assigns the host portion.

NIC recognizes three primary classes of networks: A, B, and C. In addition, NIC has recently identified two other classes: Class D for networks that support multicasting, which allows an IP datagram to be transmitted to a single multicast group consisting of hosts spread across separate physical networks; and Class E for experimental networks. The IP router does not fully support Class D or Class E networks.

Based on the size of the network, the NIC classifies a network as Class A, B, or C (the most common). The network class determines the number of bits assigned to the network and host portions of the IP address, as follows:

| Network Size | Class | Network Portion | Host Portion |
|---|---|---|---|
| More than 65,534 hosts | A | 8 bits | 24 bits |
| 254 to 65,533 hosts | B | 16 bits | 16 bits |
| Fewer than 254 hosts | C | 24 bits | 8 bits |

The position of the first bit set to 0 (whether it is the first, second, third, or fourth bit) in the first octet of an IP address indicates the network Class (A, B, C, or D). If no bit is set to 0, it is a Class E network. Figure 1-1 shows the placement of the first bit set to 0 for Class A, B, and C networks. The figure also shows how a network's class affects the network and host portions of the IP address.

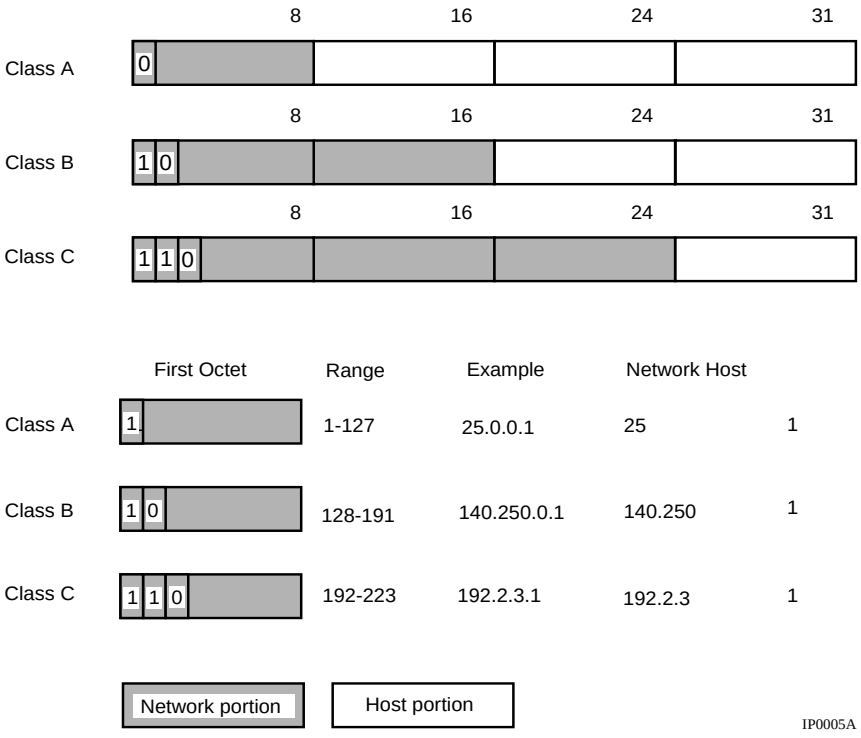



**Figure 1-1. Network and Host Portions of IP Addresses**

You specify IP addresses in dotted-decimal notation. To express an IP address in dotted-decimal notation, you convert each 8-bit octet of the IP address to a decimal number and separate the numbers by decimal points.

For example, you specify the 32-bit IP address 10000000 00100000 00001010 10100111 in dotted-decimal notation as 128.32.10.167. The most significant 2 bits (10) in the first octet indicate that the network is Class B; therefore, the first 16 bits compose the NIC-assigned network portion field. The third octet (00001010) and fourth octet (10100111) compose the host field.

## Subnet Addressing

The concept of subnetworks (or subnets) extends the IP addressing scheme. Subnets are two or more physical networks that share a common network-identification field (the NIC-assigned network portion of the 32-bit IP address). Subnets allow an IP router to hide the complexity of multiple LANs from the rest of the internet.

With subnets, you partition the host portion of an IP address into a subnet number and a "real" host number on that subnet. The IP address is then defined by *network.subnet.host*. Routers outside the network do not interpret the subnet and host portions of the IP address separately.

Routers inside a network containing subnets use a 32-bit subnet mask that identifies the extension bits. In *network.subnet.host*, the *subnet.host* portion (or the local portion) contains an arbitrary number of bits. The network administrator allocates bits within the local portion to subnet and host, and then assigns values to subnet and host.

For example, the following is the IP address of a network that contains subnets: 10000000 00100000 00001010 10100111. You specify this address in dotted-decimal notation as 128.32.10.167.

The second bit of the first octet is set to 0, indicating that the network is a Class B network. Therefore, the NIC-assigned network portion contains 16 bits, and the locally assigned local portion contains 16 bits.

The network administrator allocates the 16 bits in the local portion field as follows:

- Upper 8 bits (00001010) with a value of 10 to the subnet portion
- Lower 8 bits (10100111) with a value of 167 to the host portion

In other words, the 16-bit local portion field, together with the 16-bit network field, specify host 167 on subnet 10 of network 128.32.

You now need a subnet mask to identify those bits in the 32-bit IP address that specify the network field and those bits that specify the subnet field. Like the IP address, you specify the subnet mask in dotted-decimal notation.

You construct a subnet mask as follows:

- Assign a value of 1 to each of the 8, 16, or 24 bits in the network field.
- Assign a value of 1 to each bit in the subnet field.
- Assign a value of 0 to each bit in the host field.
- Convert the resulting 32-bit string to dotted-decimal notation.

For example, to construct a subnet mask for the IP address described earlier (10000000 00100000 00001010 10100111), do the following:

1. Assign a value of 1 to each bit in the network field.

   The position of the first bit set to 0 in the first octet of the IP address indicates that the network is Class B; therefore, the network field contains 16 bits: 11111111 11111111.

2. Assign a value of 1 to each bit in the subnet field.

   The network administrator allocated the upper 8 bits of the local portion to the subnet portion, as follows: 11111111.

3. Assign a value of 0 to each bit in the host field.

   The network administrator allocated the lower 8 bits of the local portion field to the host identification, as follows: 00000000.

4. Convert the resulting 32-bit string (11111111 11111111 11111111 00000000) to dotted-decimal notation, as follows: 255.255.255.000.

Table 1-1 shows the range of possible subnet masks for Class B and Class C addresses, along with the number of bits that the mask allocates for a subnet address, the number of recommended subnets associated with the mask, and the number of hosts per subnet.

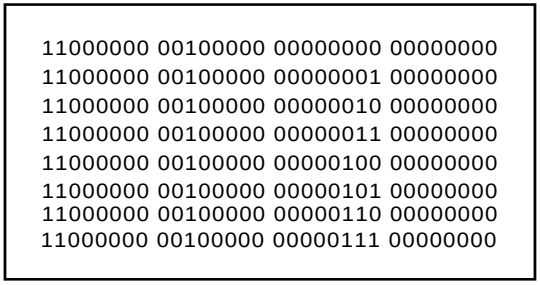
**Table 1-1. Subnet Masks for Class B and Class C Addresses**

| Number of Bits | Subnet Mask | Number of Subnets (Recommended) | Number of Hosts per Subnet |
|---|---|---|---|
| Class B | | | |
| 2 | 255.255.192.0 | 2 | 16,382 |
| 3 | 255.255.224.0 | 6 | 8,190 |
| 4 | 255.255.240.0 | 14 | 4,094 |
| 5 | 255.255.248.0 | 30 | 2,046 |
| 6 | 255.255.252.0 | 62 | 1,022 |
| 7 | 255.255.254.0 | 126 | 510 |
| 8 | 255.255.255.0 | 254 | 254 |
| 9 | 255.255.255.128 | 510 | 126 |
| 10 | 255.255.255.192 | 1,022 | 62 |
| 11 | 255.255.255.224 | 2,046 | 30 |
| 12 | 255.255.255.240 | 4,094 | 14 |
| 13 | 255.255.255.248 | 8,190 | 6 |
| 14 | 255.255.255.252 | 16,382 | 2 |
| Class C | | | |
| 2 | 255.255.255.192 | 2 | 62 |
| 3 | 255.255.255.224 | 6 | 30 |
| 4 | 255.255.255.240 | 14 | 14 |
| 5 | 255.255.255.248 | 30 | 6 |
| 6 | 255.255.255.252 | 62 | 2 |

## Supernet Addressing

A supernet is a group of networks identified by contiguous network addresses. IP service providers can assign customers blocks of contiguous addresses to define supernets as needed.

Each supernet has a unique supernet address that consists of the upper bits shared by all of the addresses in the contiguous block. For example, consider the following block of contiguous 32-bit addresses (192.32.0.0 to 192.32.7.0 in dotted-decimal notation).




IP0007A

The supernet address for this block is 11000000 00100000 00000, the 21 upper bits shared by the 32-bit addresses.

A complete supernet address consists of an *address*/*mask* pair:

- *address* is the first 32-bit IP address in the contiguous block. In this example, the address is 11000000 00100000 00000000 00000000 (192.32.0.0 in dotted-decimal notation).
- *mask* is a 32-bit string containing a set bit for each bit position in the supernet part of the address. The mask for the supernet address in this example is 11111111 11111111 11111000 00000000 (255.255.248.0 in dotted-decimal notation).

The complete supernet address in this example is 192.32.0.0/255.255.248.0.

## Classless Interdomain Routing

Classless interdomain routing (CIDR) is an addressing scheme that employs supernet addresses to represent multiple IP destinations. Rather than advertise a separate route for each destination in a supernet, a router can use a supernet address to advertise a single route -- called an *aggregate* route -- that represents all of the destinations. This reduces the size of the routing tables used to store advertised IP routes.

BGP-4 supports classless interdomain routing. OSPF supports classless routing within a domain.

# Autonomous Systems

LANs and WANs interconnected by IP routers form a group of networks called an *internet*. For administrative purposes, an internet is divided into autonomous systems. An *autonomous system* (AS) is simply a collection of routers (called gateways in IP terminology) and hosts. Figure 1-21-2depicts a sample internet segmented into three autonomous systems.

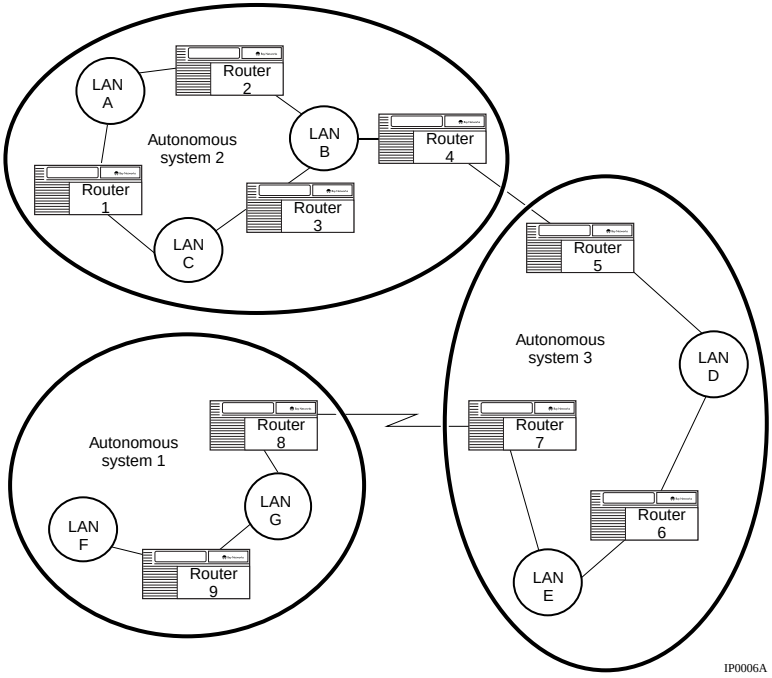



**Figure 1-2. Internet Segmented into Three Autonomous Systems**

# Routing Information Protocol (RIP)

The Routing Information Protocol (RIP) is a distance-vector protocol that enables routers in the same autonomous system to exchange routing information by means of periodic RIP updates. Routers transmit their own RIP updates to neighboring networks and listen for RIP updates from the routers on those neighboring networks. Routers use the information in the RIP updates to keep their internal routing tables current. For RIP, the “best” path to a destination is the shortest path (the path with the fewest hops). RIP computes distance as a metric, usually the number of hops (or routers) from the origin network to the target network.

## Open Shortest Path First (OSPF) Protocol

The Open Shortest Path First (OSPF) protocol is an interior gateway protocol (IGP) intended for use in large networks. Using a link state algorithm, OSPF exchanges routing information between routers in an autonomous system. Routers synchronize their topological databases. Once the routers are synchronized and the routing tables are built, the routers will flood topology information only in response to some topological change. For OSPF, the “best” path to a destination is the path that offers the least cost metric delay. In OSPF, cost metrics are configurable, allowing you to specify preferred paths.

OSPF supports CIDR and can carry supernet advertisements within a routing domain.

## Border Gateway Protocol (BGP)

The Border Gateway Protocol (BGP) is an exterior gateway protocol used to exchange network reachability information with other BGP systems. BGP routers form relationships with other BGP routers. Using an entity called a BGP speaker, BGP routers transmit and receive current routing information over a reliable transport layer connection. Because a reliable transport mechanism is used, periodic updates are not necessary.

BGP updates contain “path attributes” that describe the route to a set of destination networks. When multiple paths are available, BGP compares these path attributes to choose the preferred path.

BGP-3 and BGP-4 are supported. BGP-4 is the border gateway protocol that supports CIDR.

## Exterior Gateway Protocol (EGP)

The Exterior Gateway Protocol (EGP-2) is used to exchange network reachability information between routers in different autonomous systems. An IGP, such as RIP or OSPF, is used within an AS to facilitate the communication of routing information within the autonomous system. The routers that serve as the end points of a connection between two autonomous systems run an exterior gateway protocol, such as EGP-2.

Routers establish EGP neighbor relationships in order to periodically exchange reliable network reachability information. The router uses this information to maintain a list of gateways, the networks the gateways can reach, and the corresponding distances.

## Router Discovery Protocol

Before a host can send IP datagrams beyond its directly attached subnet, the host must discover the address of at least one operational router on that subnet. Router Discovery is an extension of the Internet Control Message Protocol (ICMP) that enables hosts attached to multicast or broadcast networks to discover the IP addresses of their neighboring routers.

Routers configured with Router Discovery periodically multicast or broadcast a router advertisement from each of their interfaces, announcing the IP address or addresses of that interface. Hosts discover the addresses of their neighboring routers by listening for these advertisements. Hosts will use the router with the highest preference level as a gateway.

# Route Preferences

The IP router maintains an internal routing table. When determining how to forward a datagram, the IP router consults the table to determine the specific route a datagram should take. A routing table can contain direct routes for the IP router's network interfaces, static routes, and the routes learned from RIP, OSPF, BGP, and/or EGP, if enabled (information about adjacent hosts is maintained in a separate table).

A routing table can contain multiple routes to the same destination. In such a situation, IP uses (among other information) a preference value to determine which route to select. Preference values range from 1 to 16 (the higher the number, the greater the preference).

By default, RIP, BGP, EGP, and OSPF external routes have a preference value of 1. Static routes, direct routes, and OSPF intra-area and interarea routes have a default preference of 16.

You can configure a preference value in the range of 1 to 16 for RIP, BGP, EGP, OSFP external, and static routes. You cannot configure the preference of direct routes and OSPF intra-area and interarea routes.

To assign a preference to a route learned by RIP, OSPF, BGP, and EGP, you configure an accept policy for the route. If an incoming route matches the policy, IP assigns the preference value you specify to the route and considers the route for possible inclusion in the routing table.

## Route Weights

Route-weight calculation is an internal tool that IP uses to facilitate selection of the best route among alternative routes to the same destination. Route-selection criteria are encoded into the route weight in a way that allows IP to compare routes simply by comparing their weight values, regardless of route sources.

Appendix D contains a worksheet that you can you use to calculate route weights in your configuration.

Route-weight calculation increases the efficiency of the route-selection process. It also reduces the size of the routing database because all route selection parameters for each route are encoded in a single integer -- the weight value -- rather than stored in separate variables.

Using selection criteria encoded in the route weight, IP chooses routes in the following order:

1. The route with the highest preference value (see “Route Preferences” on page 1-12)
2. A direct or OSPF intra-area route with the lowest metric
3. A direct route with the lowest metric
4. An OSPF intra-area route with the lowest metric
5. An OSPF interarea route with the lowest metric
6. An OSPF Type 1 external route with the lowest metric
7. A BGP route with the highest LOCAL_PREF value
8. A RIP route with the lowest metric
9. An EGP route with the lowest metric
10. A static route with the lowest metric
11. An OSPF Type 2 external route with a metric type earlier than Router Software Version 8.00

**Note:** If OSPF is configured to propagate external routes using the route weight as the type 2 metric, routes that are received as OSPF ASE type 2 routes are evaluated according to their respective origins (for example, RIP or BGP).

# IP Routing Policies and Filters

The IP router allows you to control the flow of routing data to and from the routing tables. This control is provided by two mechanisms:

- IP accept and announce policies
- IP import and export filters

**Note:** Accept and announce policies provide a superset of the parameters provided by import and export filters. Bay Networks supports both IP policies and IP route filters. However, network administrators using import and export filters for routing table management should migrate as quickly as possible to IP policies.

IP *accept policies* (and the subset of parameters provided by import filters) govern the addition of new RIP-, OSPF-, BGP-, or EGP-derived routes to the routing tables. When RIP, OSPF, BGP, or EGP receives a new routing update, it consults its accept policies to validate the information before entering the update into the routing tables. Accept policies contain search information (to match fields in incoming routing updates) and action information (to specify the action to take with matching routes).

IP *announce policies* (and the subset of parameters provided by export filters) govern the propagation of RIP, OSPF, BGP, or EGP routing information. When preparing a routing advertisement, RIP, OSPF, BGP, or EGP consults its announce policies to determine whether the routes to specific networks are to be advertised and how they are to be propagated. Announce policies contain network numbers (to associate a policy with a specific network) and action information (to specify a route propagation procedure).

Every IP router maintains a table of current routing information. The routing table manager receives routing updates from the network through the Internet protocols running on the router. Periodically, the routing table manager issues routing updates through the protocols. Figure 1-31-3shows a router configured with all of the Internet protocols supported by Bay Networks: OSPF, RIP, BGP-3, BGP-4, and EGP. The arrows indicate the direction of flow of routing information between the network and the protocols running on the router, between the protocols and the routing table manager, and between the routing table manager and the routing table.

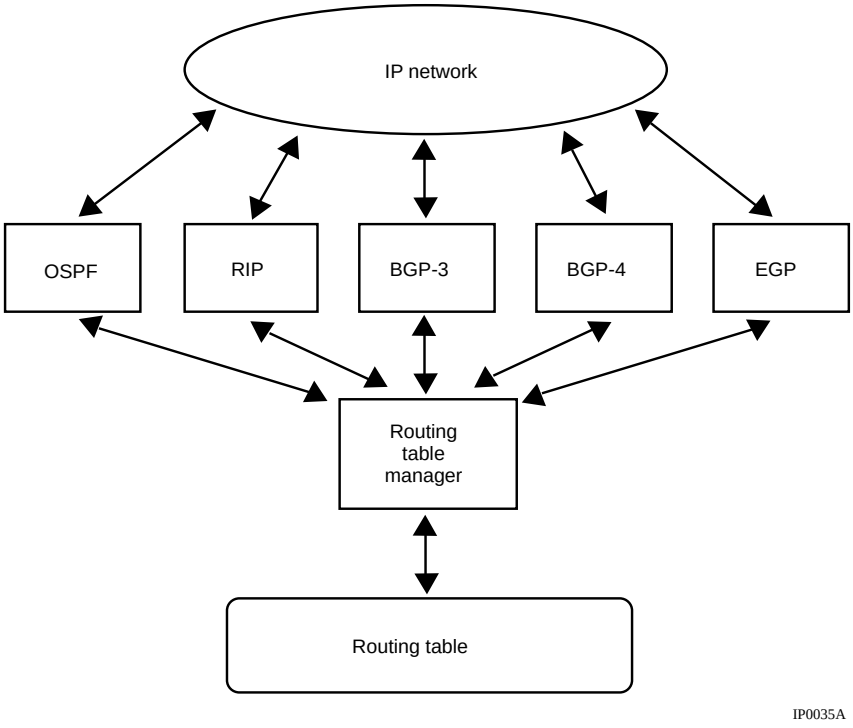



**Figure 1-3. IP Routing Table**

The flow of routing information between the network, the protocols, and the routing table manager is controlled by *routing information policies*.

Each time a routing update arrives from a remote router, the following steps occur (see Figure 1-4):

1. The protocol receiving the route consults an *accept policy* to determine whether to forward the route to the IP routing table manager or drop the route.
2. If the protocol forwards the route, the routing table manager determines whether to inject the route into the routing table.

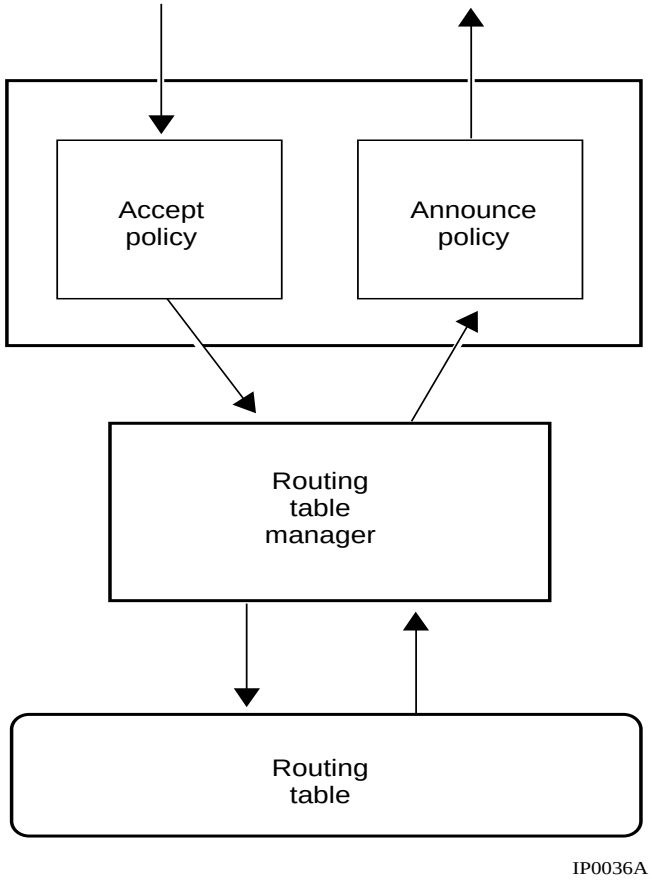



**Figure 1-4. Accept and Announce Policies**

Periodically, the routing table manager announces routes to other routers in the network as follows:

1. The routing table manager forwards a route for advertisement to the protocol.
2. The protocol consults an *announce policy* to determine whether or not to advertise the route to the network.

**Note:** The way OSPF applies accept and announce policies to routing information differs in several ways from the procedure shown in Figure 1-4. OSPF link-state advertisements (LSAs) are received and placed in the link state database (LSDB) of the router. The information in the LSDB is also propagated to other routers in the OSPF routing domain. According to the OSPF standard, all routers in a given area must maintain a similar database. To maintain database integrity across the network, a router must not manipulate received LSAs before propagating them to other routers. To accomplish this, OSPF accept and announce policies act in the following manner:

OSPF accept policies control which OSPF non-self-originated external routing information is passed to the routing table manager. The accept policies control only what the local router uses; they do not affect the propagation of OSPF internal and OSPF non-self-originated external information to other routers.

OSPF announce policies control which self-originated external routing updates are placed into the LSDB for distribution according to the OSPF standard. OSPF announce policies affect what other routers learn but only with regard to the local router's self-originated information.

IP accept and announce policies and policy parameters are described in Appendix B.

IP import and export filters and filter parameters are described in Appendix C.

# IP Traffic Filters

A traffic filter enables the router to selectively relay or drop an inbound packet, frame, or datagram based on standard protocol fields or user-defined fields. Traffic filters apply to incoming traffic only.

For information about IP traffic filters, see *Configuring Traffic Filters and Protocol Prioritization.*

# RFC Compliance

Table 1-2 lists the Internet Requests for Comments (RFCs) with which the IP router complies. This manual assumes you are familiar with these RFCs.

**Table 1-2. IP Router RFC Support**

| RFC | Specifies |
|---|---|
| 768 | User Datagram Protocol (UDP) |
| 783 | Trivial File Transfer Protocol (TFTP) |
| 791 | Internet Protocol (IP) |
| 792 | Internet Control Message Protocol (ICMP) |
| 793 and 1323 | Transmission Control Protocol |
| 826 | Address Resolution Protocol (ARP) |
| 903 | RARP server |
| 904 | EGP-2 |
| 950 | Internet subnetting procedures |
| 951 | BootP |
| 1009 | Internet gateways |
| 1027 | Proxy ARP |
| 1042 | IP over IEEE 802.*x* networks |
| 1058 and 1388 | Routing Information Protocol (RIP) |
| 1063 | Maximum transmission unit (MTU) discovery option |
| 1108 | RIPSO |
| 1112 | Host extensions for IP multicasting |
| 1157 | Simple Network Management Protocol (SNMP) |

*(continued)*

**Table 1-2. IP Router RFC Support** *(continued)*

| RFC | Specifies |
|---|---|
| 1188 | IP over FDDI networks |
| 1209 | IP over SDMS |
| 1256 | ICMP Router Discovery messages |
| 1267 | BGP-3 |
| 1293 | Inverse ARP over frame relay |
| 1332 | IP over PPP |
| 1356 | IP over X.25 |
| 1403 | BGP OSPF Interaction |
| 1483 | IP over ATM DXI, IP over PVC, IP multicast over PVC |
| 1490 | IP over frame relay |
| 1577 | IP over SVC |
| 1583 | Open Shortest Path First (OSPF) Protocol Version 2 |
| 1771 | BGP-4 |

# Chapter 2
# Starting IP Services with the BCC

This chapter shows you how to use the BCC to perform a basic configuration -- that is, a configuration using all available defaults -- for the IP services described in this manual.


| Topic | Page |
|---|---|
| Starting IP | 2-2 |
| Starting RIP | 2-3 |
| Starting OSPF | 2-4 |
| Starting BGP | 2-5 |
| Starting Router Discovery | 2-6 |

# Starting IP

To start IP on the router, you must:

1. Configure a physical interface on an available slot/connector.
2. Configure an IP interface on the physical interface.

## Step 1: Configuring a Physical Interface

To configure a physical interface on a slot and connector, navigate to the top-level box prompt and enter:

*<interface_type>* **slot** *<slot_number>* **connector** *<connector_number>*

*interface_type* is the name of a link module on the router.

*slot_number* is the number of the slot on which the link module is located.

*connector_number* is the number of a connector on the link module.

For example, the following command configures an Ethernet interface on slot 2, connector 2:

```
box# ethernet slot 2 connector 2
ethernet/2/2#
```

## Step 2: Configuring an IP Interface

To configure an IP interface on a physical interface, navigate to the prompt for the physical interface and enter:

**ip address** *<address>* **mask** *<mask>*

*address* and *mask* are a valid IP address and its associated mask, expressed in dotted-decimal notation.

For example, the following command configures IP interface 2.2.2.2/255.0.0.0 on an Ethernet physical interface on slot 2, connector 2:

```
ethernet/2/2# ip address 2.2.2.2 mask 255.0.0.0
ip/2.2.2.2/255.0.0.0#
```

An IP interface is now configured on the Ethernet interface with default values for all interface parameters. When you configure an IP interface, the BCC also configures IP globally on the router with default values for all IP global parameters.

You customize IP by modifying IP global and interface parameters as described in Chapter 4.

## Starting RIP

You start RIP on the router by adding RIP to an existing IP interface.

Navigate to an IP interface-specific prompt and enter:

**rip**

For example, the following command adds RIP to IP interface 2.2.2.2255.0.0.0:

```
ip/2.2.2.2/255.0.0.0# rip
rip/2.2.2.2#
```

RIP is now running on the router and on the interface with default values for all parameters. You customize RIP by modifying RIP parameters as described in Chapter 6.

# Starting OSPF

You start OSPF on the router by adding OSPF to an existing IP interface.

Navigate to an IP interface-specific prompt and enter:

**ospf area** *<area_id>*

*area_id* is the identifier, expressed in dotted-decimal notation, of the OSPF area to which the router is connected through the IP interface.

For example, the following command adds OSPF to IP interface 2.3.3.3/255.0.0.0. This interface connects the router to OSPF area 0.0.0.0, the OSPF backbone.

```
ip/2.3.3.3/255.0.0.0# ospf area 0.0.0.0
ospf/2.3.3.3#
```

OSPF is now running on the router and on the interface with default values for all interface parameters. You customize OSPF on the interface by modifying interface parameters as described in Chapter 7.

When you add OSPF to an IP interface, the BCC automatically starts OSPF on the router with default values for all global parameters. You customize global IP by modifying OSPF parameters as described in Chapter 7.

# Starting BGP

To start BGP:

1. Configure BGP on the router.
2. Define a BGP peer-to-peer connection.

## Step 1: Configuring Global BGP

To configure BGP on the router, navigate to the global IP prompt and enter:

**bgp**

BGP is now running on the router with default values for all BGP parameters. You customize BGP by modifying BGP parameters as described in Chapter 8.

## Step 2: Defining a Peer-to-Peer Connection

BGP exchanges routing information with BGP peers located in another autonomous system (AS) or within the same AS.

To define a peer-to-peer connection, navigate to the BGP prompt and enter:

**peer local** *<local_ip_address>* **remote** *<remote_ip_address>* **as** *<as_number>*

*local_ip_address* is the address, expressed in dotted-decimal format, of an IP interface on the local router.

*remote_ip_address* is the address of an IP interface on the remote peer's router.

*as_number* is the number of the AS in which the remote peer is located.

For example, the following command defines a peer-to-peer connection between local IP interface 2.3.3.3 and remote interface 2.3.3.4. The remote BGP peer is located in AS 4.

```
bgp# peer local 2.3.3.3 remote 2.3.3.4 as 4
peer/2.3.3.3/2.3.3.4#
```

The BGP peer-to-peer relationship is now established with default values for all BGP peer parameters. You customize the peer-to-peer connection by modifying BGP peer parameters as described in Chapter 8.

## Starting Router Discovery

You start Router Discovery by adding it to an IP interface.

Navigate to an IP interface-specific prompt and enter:

**rdisc**

The Router Discovery prompt appears.

For example, the following command adds Router Discovery to IP interface 2.2.2.2/255.0.0.0:

```
ip/2.2.2.2/255.0.0.0# rdisc
rdisc/2.2.2.2#
```

Router Discovery is now running on IP interface 2.2.2.2/255.0.0.0 with default values for all parameters. You customize Router Discovery on the interface by modifying parameters as described in “Configuring and Customizing Router Discovery” on page 4-63.

# Chapter 3
# Starting IP Services with Site Manager

This chapter shows you how to use Site Manager to perform a basic configuration -- that is, a configuration using all available defaults -- for the IP services described in this manual.


| Topic | Page |
|---|---|
| Starting IP | 3-2 |
| Starting RIP | 3-4 |
| Starting OSPF | 3-7 |
| Starting BGP | 3-9 |
| Starting EGP | 3-12 |
| Starting NAT | 3-14 |
| Using the Circuitless IP Interface | 3-16 |
| Configuring an Unnumbered IP Interface | 3-19 |

# Starting IP

Before you can select a protocol to run on the router, you must configure a circuit that the protocol can use as an interface to an attached network. For information and instructions, see *Configuring WAN Line Services* and *Configuring Ethernet, FDDI, and Token Ring Services.*

When you have successfully configured the circuit, the Select Protocols window opens. Proceed as follows:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Select Protocols window, select **IP**. Then click on **OK**. | The IP Configuration window opens. |
| 2. Set the following parameters:<br>• **IP Address**<br>• **Subnet Mask**<br>• **Transmit Bcast Addr**<br>• **UnNumbered Assoc Address**<br>Click on **Help** or see the parameter descriptions beginning on page A-27. | |
| 3. Click on **OK**. | You return to the Configuration Manager window. |

For information about unnumbered interfaces, see “Configuring an Unnumbered IP Interface” on page 3-19.

## Deleting IP from an Interface

To delete IP from an interface on which it is currently configured, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, click on the connector from which you want to delete IP services. | The Edit Connector window opens. |
| 2. Click on **Edit Circuit**. | The Circuit Definition window opens. |
| 3. Choose **Protocols**. | The Protocols menu opens. |
| 4. Choose **Add/Delete**. | The Select Protocols window opens. The IP button is highlighted to show that IP is enabled on the circuit. |
| 5. Click on **IP**. | Site Manager deletes IP services from the connector. |
| 6. Click on **OK**. | Site Manager returns you to the Circuit Definition window. |
| 7. Choose **File**. | The File menu opens. |
| 8. Choose **Exit**. | Site Manager returns you to the Configuration Manager window. |

## Customizing IP

The instructions in this chapter show you how to start IP using all default values and settings.

You customize IP by modifying IP parameters. For information, see Chapter 4.

# Starting RIP

Before you can select a protocol to run on the router, you must configure a circuit that the protocol can use as interface to an attached network. For information and instructions, see *Configuring WAN Line Services* and *Configuring Ethernet, FDDI, and Token Ring Services.*

When you have successfully configured the circuit, the Select Protocols window opens. Proceed as follows:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Select Protocols window, select the following protocols:<br>• **IP**<br>• **RIP**<br>Then click on **OK**. | The IP Configuration window opens. |
| 2. Set the following parameters:<br>• **IP Address**<br>• **Subnet Mask**<br>• **Transmit Bcast Addr**<br>• **UnNumbered Assoc Address**<br>Click on **Help** or see the parameter descriptions beginning on page A-27. | |
| 3. Click on **OK**. | You return to the Configuration Manager window. |

## Adding RIP to an IP Interface

To add RIP to an IP interface, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, click on the connector to which you want to add RIP services. | The Edit Connector window opens. |
| 2. Click on **Edit Circuit**. | The Circuit Definition window opens. |
| 3. Choose **Protocols**. | The Protocols menu opens. |
| 4. Choose **Add/Delete**. | The Select Protocols window opens. |
| 5. Click on **RIP**. | Site Manager highlights the selection. |
| 6. Click on **OK**. | Site Manager returns you to the Circuit Definition window. |
| 7. Choose **File**. | The File menu opens. |
| 8. Choose **Exit**. | Site Manager returns you to the Configuration Manager window. |

## Deleting RIP from an IP Interface

To delete RIP from an interface on which it is currently configured, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, click on the connector from which you want to delete RIP services. | The Edit Connector window opens. |
| 2. Click on **Edit Circuit**. | The Circuit Definition window opens. |
| 3. Choose **Protocols**. | The Protocols menu opens. |
| 4. Choose **Add/Delete**. | The Select Protocols window opens. The RIP button is highlighted to show that RIP is enabled on the circuit. |
| 5. Click on **RIP**. | Site Manager deletes RIP services from the connector. |
| 6. Click on **OK**. | Site Manager returns you to the Circuit Definition window. |
| 7. Choose **File**. | The File menu opens. |
| 8. Choose **Exit**. | Site Manager returns you to the Configuration Manager window. |

## Customizing RIP

The instructions in this chapter show you how to start RIP using all default values and settings.

For information about modifying RIP defaults, see Chapter 6.

# Starting OSPF

Before you can select a protocol to run on the router, you must configure a circuit that the protocol can use as interface to an attached network. For information and instructions, see *Configuring WAN Line Services* and *Configuring Ethernet, FDDI, and Token Ring Services.*

After you have successfully configured the circuit, the Select Protocols window opens. Proceed as follows:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Select Protocols window, select the following protocols:<br>• **IP**<br>• **OSPF**<br>Then click on **OK**. | The IP Configuration window opens. |
| 2. Set the following parameters:<br>• **IP Address**<br>• **Subnet Mask**<br>• **Transmit Bcast Addr**<br>• **UnNumbered Assoc Address**<br>Click on **Help** or see the parameter descriptions beginning on page A-27. | Site Manager adds OSPF to the circuit, and the Initial OSPF Global Configuration window opens. |
| 3. Set the parameters in the Initial OSPF Global Configuration window, and then click on **OK**. | The OSPF Area Address Configuration window opens. |
| 4. Set the **Area ID** parameter. Click on **Help** or see the parameter description on page A-76. | |
| 5. Click on **OK**. | The Broadcast Type window opens. |
| 6. Set the **Broadcast Type** parameter. Click on **Help** or see the parameter description on page A-77. | |
| 7. Click on **OK**. | Site Manager returns you to the Circuit Definition window. |
| 8. Choose **File**. | The File menu opens. |
| 9. Choose **Exit**. | Site Manager returns you to the Configuration Manager window. |

## Deleting OSPF from an IP Interface

To delete OSPF from an interface on which it is currently configured, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, click on the connector from which you want to delete OSPF services. | The Edit Connector window opens. |
| 2. Click on **Edit Circuit**. | The Circuit Definition window opens. |
| 3. Choose **Protocols**. | The Protocols menu opens. |
| 4. Choose **Add/Delete**. | The Select Protocols window opens. The **OSPF** button is highlighted to show that OSPF is enabled on the circuit. |
| 5. Click on **OSPF**. | Site Manager deletes OSPF services from the connector. |
| 6. Click on **OK**. | Site Manager returns you to the Circuit Definition window. |
| 7. Choose **File**. | The File menu opens. |
| 8. Choose **Exit**. | Site Manager returns you to the Configuration Manager window. |

## Customizing OSPF

The instructions in this chapter show you how to start OSPF using all default values and settings.

For information about modifying OSPF defaults, see Chapter 7.

# Starting BGP

Before you can select a protocol to run on the router, you must configure a circuit that the protocol can use as interface to an attached network. For information and instructions, see *Configuring WAN Line Services* and *Configuring Ethernet, FDDI, and Token Ring Services.*

When you have successfully configured the circuit, the Select Protocols window opens. Proceed as follows:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Select Protocols window, select the following protocols:<br>• **IP**<br>• **BGP**<br>Then click on **OK**. | The IP Configuration window opens. |
| 2. Set the following parameters:<br>• **IP Address**<br>• **Subnet Mask**<br>• **Transmit Bcast Addr**<br>• **UnNumbered Assoc Address**<br>Click on **Help** or see the parameter descriptions beginning on page A-27. | |
| 3. Click on **OK**. | The BGP Configuration window opens. |
| 4. Set the following parameters:<br>• **Identifier**<br>• **Local AS**<br>Click on **Help** or see the parameter descriptions beginning on page A-3. | |
| 5. Click on **OK**. | The BGP Peer window opens. |
| 6. Set the following parameters:<br>• **Peer Address**<br>• **Peer AS**<br>• **Local Address**<br>Click on **Help** or see the parameter descriptions beginning on page A-10. | |
| 7. Click on **OK**. | Site Manager enables default BGP service. |

## Deleting BGP from the Router

You can delete BGP from all router circuits on which it is currently enabled.

To delete BGP, complete the following steps:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Delete BGP**. | Site Manager opens a window prompting, `Do you really want to delete BGP?` |
| 5. Click on **OK**. | Site Manager removes BGP from all circuits on the router, and returns you to the Configuration Manager window. |

## Deleting BGP-3 and BGP-4 from the Router

You can delete BGP-3 and BGP-4 from all router circuits on which they are currently enabled. To delete BGP-3, complete the following steps:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Delete BGP-3**. | Site Manager opens a window prompting, `Do you really want to delete BGP?` |
| 5. Click on **OK**. | Site Manager removes BGP-3 from all circuits on the router, and returns you to the Configuration Manager window. |

To delete BGP-4, complete the following steps:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Delete BGP-4**. | Site Manager opens a window prompting, `Do you really want to delete BGP4?` |
| 5. Click on **OK**. | Site Manager removes BGP-4 from all circuits on the router, and returns you to the Configuration Manager window. |

## Customizing BGP

The instructions in this chapter show you how to start BGP using all default values and settings.

For information about modifying BGP defaults, see Chapter 8.

# Starting EGP

Before you can select a protocol to run on the router, you must configure a circuit that the protocol can use as interface to an attached network.For information and instructions, see *Configuring WAN Line Services* and *Configuring Ethernet, FDDI, and Token Ring Services.*

When you have successfully configured the circuit, the Select Protocols window opens. Proceed as follows:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Select Protocols window, select the following protocols:<br>• **IP**<br>• **EGP**<br>Then click on **OK**. | The IP Configuration window opens. |
| 2. Set the following parameters:<br>• **IP Address**<br>• **Subnet Mask**<br>• **Transmit Bcast Addr**<br>• **UnNumbered Assoc Address**<br>Click on **Help** or see the parameter descriptions beginning on page A-27. | |
| 3. Click on **OK**. | The EGP Configuration window opens. |
| 4. Set the following parameters:<br>• **Local Autonomous System ID (decimal)**<br>• **Remote Peer IP Address**<br>• **Gateway Mode**<br>Click on **Help** or see the parameter descriptions beginning on page A-23. | |
| 5. Click on **OK**. | Site Manager enables EGP service, and returns you to the Configuration Manager window. |

## Deleting EGP from the Router

You can delete EGP from all router circuits on which it is currently enabled. To delete EGP, complete the following steps:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **EGP**. | The BGP menu opens. |
| 4. Choose **Delete EGP**. | Site Manager opens a window prompting, `Do you really want to delete EGP?` |
| 5. Click on **OK**. | Site Manager removes EGP from all circuits on the router, and returns you to the Configuration Manager window. |

## Customizing EGP

The instructions in this chapter show you how to start EGP using all default values and settings.

For information about modifying EGP defaults, see Chapter 9.

# Starting NAT

Before you can choose a protocol to run on the router, you must configure a circuit that the protocol can use as an interface to an attached network. For information and instructions, see *Configuring Ethernet, FDDI, and Token Ring Services* or proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Select Protocols window, select the following protocols:<br>• **IP**<br>• **NAT**<br>Then click on **OK**. | The IP Configuration window opens. |
| 2. Set the following parameters:<br>• **IP Address**<br>• **Subnet Mask**<br>• **Transmit Bcast Addr**<br>• **UnNumbered Assoc Address**<br>Click on **Help** or see the parameter descriptions beginning on page A-27. | |
| 3. Click on **OK**. | You return to the Configuration Manager window. |

## Adding NAT to an IP Interface

To add NAT to an IP interface, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, click on the connector to which you want to add NAT services. | Site Manager highlights the connector. |
| 2. Click on **Edit Circuit**. | The Circuit Definition window opens. |
| 3. Choose **Protocols**. | The Protocols menu opens. |
| 4. Choose **Add or Delete**. | The Select Protocols window opens. |

*(continued)*

| Site Manager Procedure *(continued)* | |
|---|---|
| **You do this** | **System responds** |
| 5. Click on **NAT**. | Site Manager highlights the selection. |
| 6. Click on **OK.** | The NAT Global Configuration window opens. |
| 7. Accept the defaults for the NAT interface global parameters. | The NAT Interface Configuration window opens. |
| 8. Accept the default (LOCAL). | |
| 9. Click on **OK**. | Site Manager returns you to the Circuit Definition window. |
| 10. Choose **File**. | The File menu opens. |
| 11. Choose **Exit**. | Site Manager returns you to the Configuration Manager window. |

## Deleting NAT from an IP Interface

To delete NAT from an interface on which it is currently configured, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, click on the connector from which you want to delete NAT services. | Site Manager highlights the connector. |
| 2. Click on **Edit Circuit**. | The Circuit Definition window opens. |
| 3. Choose **Protocols**. | The Protocols menu opens. |
| 4. Choose **Delete**. | The Select Protocols window opens. The NAT button is highlighted to show that NAT is enabled on the circuit. |
| 5. Click on **NAT**. | Site Manager deletes NAT services from the connector. |
| 6. Click on **OK**. | Site Manager returns you to the Circuit Definition window. |
| 7. Choose **File**. | The File menu opens. |
| 8. Choose **Exit**. | Site Manager returns you to the Configuration Manager window. |

# Using the Circuitless IP Interface

A *circuitless* IP interface has an IP address that is not mapped to a specific circuit. If one or more of the router's IP interfaces become disabled, this circuitless feature ensures that the router is always reachable using the circuitless IP interface address, as long as a viable path to the router exists. The IP router can support one circuitless IP interface.

IP traffic is delivered to and transmitted from the circuitless interface in the same way as any other IP interface. In addition, the circuitless IP interface can receive packets from any application.

When you configure a circuitless IP interface, note the following:

- You can configure one circuitless IP interface per router. Additional circuitless IP interfaces will not initialize.
- You can add BGP and OSPF to a circuitless interface.
- You must assign a unique IP address and subnetwork number to the circuitless IP interface.
- You *cannot* configure a circuitless IP interface in nonforwarding mode.

## Starting IP on the Circuitless Interface

To configure a circuitless IP interface, begin at the Configuration Manager window and proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Circuitless IP**. | The Circuitless IP menu opens. |
| 4. Choose **Create**. | The IP Configuration window opens. |
| 5. Click on **OK**. | Site Manager saves the circuitless IP interface, and opens a special Select Protocols window that lists the protocols that you can configure on a circuitless interface. |
| 6. Choose a protocol and click on **OK**. | A configuration window opens for the protocol you selected. |

## Choosing Slots to Support the Circuitless Interface

By default, all slots support the IP circuitless interface.

You can use Site Manager to specify the slots that can support the circuitless interface.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | The window displays the parameter values for that interface. |
| 5. Set the **Mask** parameter. Click on **Help** or see the parameter description on page A-39. | |
| 6. Click on **Apply**, and then click on **Done.** | Site Manager returns you to the Configuration Manager window. |

# Configuring an Unnumbered IP Interface

IP allows you to configure an interface on a point-to-point connection without using an IP address. Such an interface is called an *unnumbered interface*. Point-to-point connections using unnumbered interfaces can be configured to advertise RIP, OSPF, IBGP, DVMRP, and static routes.

The ability to establish a point-to-point link using an unnumbered IP interface helps alleviate two of the major problems caused by the continued rapid growth of the Internet: exhaustion of Class B network addresses and of the 32-bit IP address space.

You associate each unnumbered interface with the IP address of any numbered interface on the router, including the circuitless interface. The router can support multiple unnumbered interfaces. Multiple unnumbered interfaces can be associated with the same IP address.

**Note:** The associated address assigned to the unnumbered interface determines whether or not RIP configured to send updates in V1 mode will advertise a subnetwork over the unnumbered interface. The associated address also determines which mask is applied to RIP V1 updates received on that interface. For unnumbered links using RIP V1, the defined associated addresses at each end of the link must belong to the same network and have the same mask for routes to be exchanged correctly.

If a subnetwork on the router has the same mask as the associated address, RIP V1 will advertise that subnet over the unnumbered interface. If the mask on the subnetwork is different from the mask of the associated address, RIP V1 advertises only the natural network of the subnet.

Bay Networks recommends that you select RIP2 mode for unnumbered interfaces. With RIP2, RIP updates contain both the route and mask information.

Because all traffic over an unnumbered interface uses broadcast addressing at the link layer, neither an adjacent host specification nor address resolution is required.

**Note:** BGP peers, NetBIOS, and BootP cannot be configured directly on an unnumbered interface.

For information about using Site Manager to configure a BGP peer-to-peer session on routers connected through unnumbered interfaces, see “Configuring Peers over an Unnumbered Point-to-Point Link” on page 8-59.

To route NetBIOS packets over an unnumbered interface, you must configure a static entry to the name server.

To run BootP over unnumbered interfaces, you must select a preferred BootP server. For instructions, see *Configuring SNMP, BootP, DHCP, and RARP Services*.

As it does with routes learned over numbered interfaces, IP stores each route learned over an unnumbered interface in the routing table.

The routing-table entry for a route learned over an unnumbered interface contains the following values:

| | |
|---|---|
| Next-hop address | 0 |
| Next-hop mask | 0 |
| Next-hop interface | Circuit number of the unnumbered interface |

**Note:** Unnumbered interfaces cannot be pinged directly. For this reason, such interfaces can make it difficult to diagnose router problems.

## Using the Alternate Associated Address Option

The alternate associated address option ensures that a network on an unnumbered interface remains reachable. IP automatically assigns an alternate associated address to an unnumbered interface in the event that the primary associated address has gone down. IP uses the first available interface.

**Note:** In the event that an unnumbered associated address becomes unreachable, some functionality may be lost for certain protocols over the unnumbered interface.

**Note:** In some configurations, changing the associated address can affect the way routes are advertised. For example, if you change the associated address for an unnumbered interface configured with RIP, you may change the way RIP advertises subnets.

You can use Site Manager to enable the associated address option.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | The window displays the parameter values for that interface. |
| 5. Set the **Unnumbered Associated Alternate** parameter. Click on **Help** or see the parameter description on page A-41. | |
| 6. Click on **Apply**, and then click on **Done.** | Site Manager returns you to the Configuration Manager window. |

# Chapter 4
# Configuring and Customizing IP

You customize IP services by setting parameters as described under the following topics:


| Topic | Page |
|---|---|
| Customizing IP Global Parameters | 4-2 |
| Customizing an IP Interface | 4-26 |
| Configuring an Adjacent Host Address | 4-53 |
| Defining a Static Route | 4-56 |
| Defining a Static Black Hole for a Supernet | 4-62 |
| Configuring and Customizing Router Discovery | 4-63 |

# Customizing IP Global Parameters

When you configure an IP interface on a slot, IP is automatically configured globally on the slot with default values for all global parameters. You customize global IP by modifying global IP parameters as described under the following topics:


| Topic | Page |
|---|---|
| Navigating the BCC to the IP Global Prompt | 4-3 |
| Opening the Site Manager Window for IP Global Parameters | 4-4 |
| Disabling and Reenabling Global IP | 4-5 |
| Configuring the Router for Not-Forwarding Mode | 4-6 |
| Configuring Bridging on a Router in Not-Forwarding Mode | 4-8 |
| Setting the Time-to-Live Value on a Source Packet | 4-11 |
| Allowing an All-Zero or All-One Subnet Address | 4-13 |
| Estimating the Size of the Routing Table | 4-14 |
| Using a Default Route for an Unknown Subnet | 4-15 |
| Specifying the Maximum Number of IP Policies | 4-16 |
| Disabling and Reenabling Route Filter Support | 4-17 |
| Enabling Equal-Cost Multipath Support | 4-18 |
| Configuring Equal-Cost Multipath for RIP and OSPF | 4-20 |
| Enabling and Disabling ECMP Support for IBGP | 4-22 |
| Enabling ISP Mode on the Router | 4-22 |
| Customizing the IP Routing Table Structure | 4-24 |
| Specifying the Percentage of Buffers Available to ARP | 4-25 |

## Navigating the BCC to the IP Global Prompt

Beginning at the top-level box prompt, enter:

**ip**

The IP global prompt appears.

To display the current values for all IP global parameters, enter:

**info**

For example, the following command sequence invokes the IP global prompt and displays current values for IP global parameters:

```
box# ip
ip# info
  on box
  state enabled
  forwarding forwarding
  ttl 30
  cache-timeout default
  mib-table route
  all-subnets disabled
  classless disabled
  max-policies 32
  route-filters enabled
  rip-max-paths 1
  ecmp-method disabled
  isp-mode disabled
  ospf-max-paths 1
  icmp-error-limit 0
ip#
```

## Opening the Site Manager Window for IP Global Parameters

Use the following Site Manager procedure to open the IP Global Parameters window, which displays all IP global parameters and their current values:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |

## Disabling and Reenabling Global IP

IP is enabled on the slot by default. You can change the state of IP as required.

### *Using the BCC*

Navigate to the IP global prompt and enter:

**state** <*state*>

*state* is one of the following:

**enabled** (default)
**disabled**

For example, the following command disables IP on the router:

```
ip# state disabled
ip#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **Enable** parameter. **Click on Help or see the parameter description on page A-43.** | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring the Router for Not-Forwarding Mode

By default, IP forwards all packets that are not addressed to itself. You can also configure IP in *not-forwarding* -- or *host-only* -- mode.

Use the forwarding mode if you want the IP router to route (forward) IP traffic. Forwarding configures the IP router to process all broadcast packets and all IP packets explicitly addressed to it, and to route all other IP packets.

Choose not-forwarding mode on the router if you want to provide IP management access (by means of TFTP and SNMP) to all active IP interfaces but also want to prohibit the IP router from forwarding IP traffic. You must specify an identical IP address and mask combination for each active IP interface that will provide management access. Not-forwarding mode configures the IP router to act as an IP host; it does not forward IP traffic, but it still processes packets explicitly addressed to it. In not-forwarding mode, only static routes and adjacent-host routes are allowed. No routing protocols are initiated.

You can use the BCC or Site Manager to select the forwarding mode.

### *Using the BCC*

Navigate to the IP global prompt and enter:

**forwarding** <*mode*>

*mode* is one of the following:

**forwarding** (default)
**notforwarding**

For example, the following command puts the router in not-forwarding mode:

```
ip# forwarding notforwarding
ip#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **Forwarding** parameter. Click on **Help** or see the parameter description on page A-43. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring Bridging on a Router in Not-Forwarding Mode

Because the IP router does not forward IP traffic in not-forwarding mode, you must configure the router to bridge IP traffic not explicitly addressed to it. You must configure the bridge for each circuit that conveys IP datagrams. The bridge will then forward all IP datagrams that are not explicitly addressed to the router.

Table 4-1 and Table 4-2 show valid and invalid configurations for source routing bridges and learning bridges. Each configuration has the following format:

source_device > medium > destination_device

or

source_device > medium1 > intermediate_device > medium2 > destination_device

**Table 4-1. Source Routing Bridge Support for Host-Only Mode**

| Bridge Configuration | Support |
|---|---|
| Bay* > Eth† > Bay | Supported |
| Bay > Token‡ > Bay | Supported |
| Bay > FDDI** > Bay | Supported |
| Bay > PTP†† > Bay | Supported |
| Bay > FR‡‡ > Bay | Supported |
| Bay > SMDS*** > Bay | Supported |
| Bay > PPP††† > Bay | Not supported |
| Bay > Eth > Bay >Token > ES‡‡‡ | Not supported |
| Bay > Token > Bay > Token > ES | Supported |
| Bay > FDDI > Bay > Token > ES | Not supported |
| Bay > PTP > Bay > Token > ES | Not supported |
| Bay > FR > Bay > Token > ES | Not supported |
| Bay > SDMS > Bay > Token > ES | Not supported |
| Bay > PPP > Bay > Token > ES | Not supported |
| ES > Token > Bay > Eth > Bay | Not supported |
| ES > Token > Bay > Token > Bay | Supported |

*(continued)*

**Table 4-1. Source Routing Bridge Support for Host-Only Mode** *(continued)*

| Bridge Configuration | Support |
|---|---|
| ES > Token > Bay > FDDI > Bay | Not supported |
| ES > Token > Bay > PTP > Bay | Not supported |
| ES > Token > Bay > FR > Bay | Not supported |
| ES > Token > Bay > SDMS > Bay | Not supported |
| ES > Token > Bay > PPP > Bay | Not supported |
| ES > Token > Bay > Eth > Bay > Token > ES | Supported |
| ES > Token > Bay > Token > Bay > Token > ES | Supported |
| ES > Token > Bay > FDDI > Bay > Token > ES | Supported |
| ES > Token > Bay > PTP > Bay >Token > ES | Supported |
| ES > Token > Bay > FR > Bay > Token > ES | Supported |
| ES > Token > Bay > SDMS > Bay > Token > ES | Supported |
| ES > Token > Bay > PPP > Bay > Token > ES | Supported |

* Bay Networks router with bridge and IP in host-only mode

† Ethernet connection

‡ Token ring connection

**FDDI connection

††Bay Networks proprietary point-to-point synchronous connection

‡‡Frame relay synchronous connection

***SMDS synchronous connection

†††PPP synchronous connection

‡‡‡Station you are communicating to or from if not Bay Networks

**Table 4-2. Learning Bridge Support for Host-Only Mode**

| Bridge Configuration | Support |
|---|---|
| Bay* > Eth† > Bay | Supported |
| Bay > Token‡ > Bay | Supported |
| Bay > FDDI** > Bay | Supported |
| Bay > PTP†† > Bay | Supported |
| Bay > FR‡‡ > Bay | Supported |
| Bay > SMDS*** > Bay | Supported |

*(continued)*

**Table 4-2. Learning Bridge Support for Host-Only Mode** *(continued)*

| Bridge Configuration | Support |
|---|---|
| Bay > PPP††† > Bay | Not supported |
| Bay > Eth > Bay > Eth > ES‡‡‡ | Supported |
| Bay > Token > Bay > Eth > ES | Not supported |
| Bay > FDDI > Bay > Eth > ES | Supported |
| Bay > PTP > Bay > Eth > ES | Supported |
| Bay > FR > Bay > Eth > ES | Not supported |
| Bay > SDMS > Bay > Eth > ES | Not supported |
| Bay > PPP > Bay > Eth > ES | Not supported |
| ES > Eth > Bay > Eth > Bay | Supported |
| ES > Eth > Bay > Token > Bay | Not supported |
| ES > Eth > Bay > FDDI > Bay | Supported |
| ES > Eth > Bay > PTP > Bay | Supported |
| ES > Eth > Bay > FR > Bay | Not supported |
| ES > Eth > Bay > SDMS > Bay | Not supported |
| ES > Eth > Bay > PPP > Bay | Not supported |
| ES > Eth > Bay > Eth > Bay > Eth > ES | Supported |
| ES > Eth > Bay > Token > Bay > Eth > ES | Supported |
| ES > Eth > Bay > FDDI > Bay > Eth > ES | Supported |
| ES > Eth > Bay > PTP > Bay > Eth > ES | Supported |
| ES > Eth > Bay > FR > Bay > Eth > ES | Supported |
| ES > Eth > Bay > SDMS > Bay > Eth > ES | Supported |
| ES > Eth > Bay > PPP > Bay > Eth > ES | Supported |

* Bay Networks router with bridge and IP in host-only mode

† Ethernet connection

‡ Token ring connection

**FDDI connection

††Bay Networks proprietary point-to-point synchronous connection

‡‡Frame relay synchronous connection

***SMDS synchronous connection

†††PPP synchronous connection

‡‡‡Station you are communicating to or from if not Bay Networks

## Setting the Time-to-Live Value on a Source Packet

Each IP data packet includes a *time-to-live* (TTL) value. The TTL value specifies the maximum number of hops that the packet is allowed to traverse in the network before an intermediate router discards the packet.

The router that originates the packet sets the TTL to a positive value. Each router that receives the packet decrements the TTL counter by one. A router that receives a packet with a TTL of zero discards the packet -- if the packet is not addressed to itself. The TTL counter prevents packets from looping endlessly through the network.

By default, IP sets the TTL field on each source packet (that is, each packet that it originates and transmits) to 30 hops. You can use the BCC or Site Manager to set the TTL value as required.

### *Using the BCC*

Navigate to the global IP prompt and enter:

**time-to-live** *<max_hops>*

*max_hops* is the maximum number of hops the packet can traverse before an intermediate router discards it.

For example, the following command sets the TTL value to 25 hops:

```
ip# time-to-live 25
ip#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **Default TTL** parameter. Click on **Help** or see the parameter description on page A-45. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Allowing an All-Zero or All-One Subnet Address

By default, for IP, an address with a subnet portion of all zeros or all ones is an illegal address.

You can configure IP to allow an all-zero and all-one subnet address. Enable this feature with caution, however, for it can result in an ambiguous address. For example, if an all-zero subnet address and an all-zero broadcast address are both valid, the router cannot distinguish an all-subnets broadcast from a directed broadcast for the zero subnet.

### *Using the BCC*

Navigate to the IP global prompt and enter:

**all-subnets enabled**

For example:

```
ip# all-subnets enabled
ip#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **Zero Subnet Enable** parameter. Click on **Help** or see the parameter description on page A-46. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Estimating the Size of the Routing Table

IP allows you to estimate how many networks and hosts require an entry in the IP routing table. The router uses your estimate to preallocate memory for the routing table. Preallocation of memory increases the speed with which IP software can learn routes because it removes the overhead caused by dynamic memory allocation. Preallocation also makes better use of memory and reduces the amount of memory required. By default, the router allocates resources to support 500 network and host entries in the routing table.

If you have enabled ISP mode, the default value is 40,000 entries. You must reduce this value to an appropriate size if the system is running with 8-MB or 16-MB processor modules. Failure to change the value will result in an out-of-memory error on these processors.

Avoid making an estimate that is excessively large; doing so will cause a wasteful overallocation of memory.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the following parameters:<br>• **Estimated Networks**<br>• **Estimated Hosts**<br>Click on **Help** or see the parameter descriptions beginning on page A-47. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Using a Default Route for an Unknown Subnet

By default, IP drops packets addressed to an unknown subnet and returns an ICMP to the sender. This prevents local traffic from accidentally following the default route to the Internet.

In cases where remote sites follow a default route to a central site, it is appropriate to enable this parameter. If the router serves as an Internet gateway (with a default route to the Internet), the parameter can be disabled.

The default route must be present in the routing table.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **Enable Default Route for Subnets** parameter. Click on **Help** or see the parameter description on page A-48. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Specifying the Maximum Number of IP Policies

By default, IP allows you configure up to 32 announce policies and 32 accept policies for each protocol that you configure on the router. You must increase this value if you want IP to allocate more memory and implement additional policies.

### *Using the BCC*

Navigate to the IP global prompt and enter:

**max-policies** *<max_policies>*

*max_policies* is the maximum number of accept and announce policies you can configure for each routing protocol.

For example, the following command sets the maximum policy value to 50:

```
ip# max-policies 50
ip#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **Maximum Policy Rules** parameter. Click on **Help** or see the parameter description on page A-48. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Disabling and Reenabling Route Filter Support

By default, IP supports route filters. When route filter support is disabled, IP does not allocate memory for route filters when the maximum number of IP policies is increased. You can use the BCC or Site Manager to disable and reenable this feature as required.

### *Using the BCC*

Navigate to the IP global prompt and enter:

**route-filters** <*state*>

*state* is one of the following:

**enabled** (default)
**disabled**

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **Route Filter Support** parameter. Click on **Help** or see the parameter description on page A-48. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Enabling Equal-Cost Multipath Support

By default, IP stores the best next hop to a destination in the routing table. If traffic arrives on an interface, IP determines the best route to the destination and forwards all packets out the next-hop interface.

*IP equal-cost multipath support* (ECMP) is a load-balancing feature that allows IP to distribute traffic over multiple (up to five) equal-cost paths to the same destination.

IP supports three methods of distribution for equal-cost routes:

- *Round-robin* distribution. IP forwards each packet to a different next hop until it reaches the end of the list of available next hops; then it repeats the list. Round-robin distribution makes full use of available resources but may cause packets to be delivered out of order.
- *Source-destination hash* distribution based on the source and destination address. IP forwards all packets with a given source and destination address to the same next hop. This method increases the chances that the packets will be delivered in order.
- *Destination-hash* distribution based on the destination address only. IP forwards all packets with a given destination address to the same next hop.

By default, equal-cost multipath support is disabled on the router. You can use the BCC or Site Manager to enable the feature and choose a distribution method.

### *Using the BCC*

Navigate to the IP global prompt and enter:

**ecmp-method** *<method>*

*method* is one of the following:

**disabled** (default)
**roundRobin**
**srcDestHash**
**destinationHash**

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **Multiple Nexthop Calculation Method** parameter. Click on **Help** or see the parameter description on page A-49. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring Equal-Cost Multipath for RIP and OSPF

By default, the IP routing table contains a single “best” RIP route and single best OSPF route to a given destination. If either protocol submits another route to the same destination, IP compares the new route with the current route. If the new route is better, IP replaces the current route with the new route. If not, IP discards the new route.

If you have enabled equal-cost multipath support on the router, IP can store multiple equal-cost best RIP and OSPF routes in the routing table. When RIP or OSPF submits a route to a destination, one of the following events occurs:

- IP determines that the current route to that destination is better than the new route. IP discards the new route.
- IP determines that the new route is better than the current route. IP discards the current route and replaces it with the new route. In the event that the routing table contains multiple equal-cost best routes, IP discards all of these routes.
- IP determines that the new route and the current route have the same cost. IP adds the new route to the routing table -- up to a maximum number that you specify. If the routing table already contains the maximum number of equal-cost routes from RIP or OSPF, IP discards the route.

You can use the BCC and Site Manager to specify the number of equal-cost routes (up to five) that IP can store in the routing table for RIP and OSPF.

### *Using the BCC*

To specify the maximum number of equal-cost paths for RIP, navigate to the IP global prompt and enter:

**rip-max-paths** *<max_number>*

*max_number* is an integer from 1 (the default) to 5.

To specify the maximum number of equal-cost paths for OSPF, navigate to the IP global prompt and enter:

**ospf-max-paths** *<max_number>*

*max_number* is an integer from 1 (the default) to 5.

For example, the following command sequence enables round-robin ECMP routing and allows up to five distribution paths for RIP and OSPF:

```
ip# ecmp-method roundRobin
ip# rip-max-paths 5
ip# ospf-max-paths 5
ip#
```

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the following parameters as desired:<br>• **RIP Maximum Equal Cost Paths**<br>• **IP OSPF Maximum Path**<br>Click on **Help** or see the parameter descriptions beginning on page A-49. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Enabling and Disabling ECMP Support for IBGP

By default, in cases where IBGP uses the IP routing table to determine the next IP hop to an IBGP peer, IBGP does not consider equal cost multipath routes submitted by RIP or OSPF.

You can use the BCC or Site Manager to enable ECMP support for IBGP. For information and instructions, see “Configuring IBGP for Route and Traffic-Load Balancing” on page 8-100.

## Enabling ISP Mode on the Router

IP provides an Internet Service Provider (ISP) mode of operation. In ISP mode, IP does the following:

- Enables the BGP soloist. By default, BGP runs on all slots configured with IP interfaces. In ISP mode, BGP runs as a soloist.
- Disables IP forwarding caches. By default, IP maintains a forwarding cache on each IP interface. IP maintains this table as a cache for routes that are frequently used to forward data packets that arrive on the interface. However, if the number of frequently-used routes exceeds the size of the forwarding table, the router continually updates the forwarding cache by removing old routes and installing new route entries. ISP mode disables all forwarding caches on all IP interfaces and optimizes the routing table to allow direct forwarding, avoiding the overhead of cache misses and cache updates. If you choose ISP mode, you do not have to explicitly disable the forwarding tables on each interface.

The following parameter settings also help optimize router performance and operation:

| IP Global Parameter | Setting |
|---|---|
| Route Filter Support | Disabled |
| Maximum Policy Rules | Set as required |
| Estimated Networks | Set as required |
| ICMP Redirects | Set to off at router interconnection points |

By default, ISP mode features are disabled on the router. You can use the BCC or Site Manager to enable and disable ISP mode as required.

### *Using the BCC*

Navigate to the IP global prompt and enter:

**isp-mode** *<state>*

*state* is one of the following:

**enabled**
**disabled** (default)

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **Enable ISP Mode Support** parameter to Enable. Click on **Help** or see the parameter description on page A-50. | |
| 5. Click on **OK**. | The Edit Soloist Slot window opens. |
| 6. Choose a slot and click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Customizing the IP Routing Table Structure

Structurally, the IP routing table consists of *indexes* and *entries*. Each index contains a pointer to a sublist of entries. By default, the IP routing table contains 8,000 indexes.

A routing table in which all indexes point to the same number of entries is considered to be in perfect *balance*. For example, a routing table that contains 100 indexes pointing to 1,000 entries is in perfect balance if each index points to 10 entries.

In reality, an IP routing table is allowed to contain indexes that deviate from perfect balance by a number of entries specified as the *deviation-of-nodes* value. By default the deviation-of-nodes value is 25.

To use the BCC to specify the number of indexes in the IP routing table and to specify a deviation-of-nodes value, enter the following commands:

**rtbl-indexes** *<number>*
**rtbl-deviation-of-nodes** *<deviation>*

*number* is the number of indexes in the IP routing table.

*deviation* is the number of entries by which an index is allowed to deviate from perfect balance.

For example, the following command sequence configures an IP routing table with 1,000 indexes and a deviation value of 10:

```
ip# rtbl-indexes 1000
ip# rtbl-deviation-of-nodes 10
```

**Caution:** Bay Networks recommends that you use the default values for the IP routing table parameters. If you want to specify different values, consult the Bay Networks Technical Solutions Center.

## Specifying the Percentage of Buffers Available to ARP

By default, ARP can use 100 percent of the available buffers for saving buffers when resolving ARP requests.

You can use Site Manager to specify the percentage of buffers available to ARP.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **Percentage of ARP Buffers** parameter. Click on **Help** or see the parameter description on page A-50. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

# Customizing an IP Interface

An IP network *interface* consists of a physical circuit configured with the appropriate data link and IP protocols. Each interface connects the router to one or more IP networks.

For example, the router in Figure 4-14-1is configured with three IP interfaces. One of these interfaces is a point-to-point interface that connects the router to a single long-haul medium terminated by a host or another router. The other two interfaces are LAN interfaces that connect the router to an Ethernet or FDDI local area medium.

An IP interface can provide access to multiple networks. For example, in Figure 4-1, LAN interface 1 provides a connection to both LAN B and LAN C.

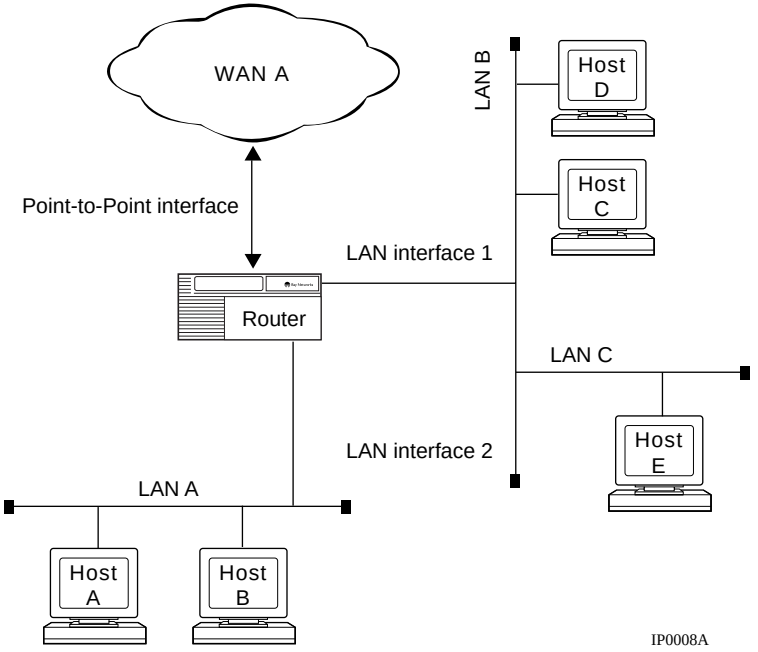



**Figure 4-1. IP Interface**

**Note:** When you reconfigure an interface in dynamic mode, IP restarts on that interface. Thus, if the interface you reconfigure is the interface that supports Site Manager's SNMP connection to the router, restarting IP on that interface causes Site Manager to temporarily lose its router connection and to display a warning message. To verify that the change took effect, display the IP Global Parameters window and inspect the setting.

If you are configuring IP over an SMDS circuit, be sure to enter the correct addresses for the MAC Address, SMDS Group Address, and SMDS Arp Req Address parameters. These addresses are the same as those you entered in the Individual Address, Group Address, and ARP Address parameters of the SMDS Configuration window when you configured SMDS.

When you configure an IP interface on a circuit, the interface is enabled with default values for all interface parameters. You customize an IP interface by modifying parameters as described under the following topics:


| Topic | Page |
|---|---|
| Navigating the BCC to an IP Interface Prompt | 4-29 |
| Opening the Site Manager Window for IP Interface Parameters | 4-30 |
| Configuring a Multinet Interface | 4-31 |
| Disabling and Reenabling an IP Interface | 4-32 |
| Specifying a Broadcast Address for an Interface | 4-33 |
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| Specifying the Cost of an Interface | 4-35 |
| Enabling MTU Discovery on an Interface | 4-36 |
| Enabling and Disabling ICMP Address-Mask Replies | 4-38 |
| Disabling and Reenabling ICMP Redirect Messages | 4-39 |
| Enabling All-Subnet Broadcasting on an Interface | 4-41 |
| Disabling UDP Checksum Processing on the Interface | 4-42 |
| Specifying a MAC Address or E.164 Address | 4-43 |
| Enabling Source Routing over a Token Ring Network | 4-44 |
| Configuring an SMDS Address | 4-47 |
| Configuring a WAN Address for a Frame Relay Network | 4-48 |
| Specifying the Maximum Size of the Forwarding Table | 4-49 |
| Configuring an Interface for an ATM Logical IP Subnet | 4-51 |

## Navigating the BCC to an IP Interface Prompt

Beginning at the prompt for the slot/connector on which you have configured the IP interface, enter:

**ip address** *<ip_address>* **mask** *<address_mask>*

*ip_address* is the IP address you have assigned to the interface.

*address_mask* is the mask associated with the IP address.

The prompt for the IP interface appears.

To display the current (default) values of the parameters for this interface, enter:

**info**

For example, the following command sequence:

1. Invokes the prompt for IP interface 2.2.2.2/255.0.0.0 (which has been configured on Ethernet slot 2, connector 2).
2. Displays the current parameter values for IP interface 2.2.2.2.

```
ethernet/2/2# ip address 2.2.2.2 mask 255.0.0.0
ip/2.2.2.2/255.0.0.0# info
  on ethernet/2/2
  state enabled
  address 2.2.2.2
  mask 255.0.0.0
  assocaddr 0.0.0.0
  cost 1
  broadcast 0.0.0.0
  configured-mac-address 0x
  mtu-discovery off
  mask-reply off
  all-subnet-broadcast off
  address-resolution arp
  proxy off
  host-cache-aging cache-off
  udp-checksum on
  end-station-support off
  redirects on
  cache-size 128
ip/2.2.2.2/255.0.0.0#
```

## Opening the Site Manager Window for IP Interface Parameters

Use the following Site Manager procedure to open the IP Interface List window, which displays all IP interface parameters and their current values:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |

## Configuring a Multinet Interface

The *multinet* capability allows you to assign multiple IP network/subnet addresses to a single circuit; each IP address represents a separate network interface on the circuit.

Multinet is commonly used in IP networks as part of a transition strategy. As networks evolve it is sometimes necessary to consolidate several physical networks. To avoid readdressing, the physical networks can be consolidated onto a multinetted router interface. This allows hosts to migrate to the new IP interface or maintain the old IP address.

In Figure 4-2, for example, host A and host C are located on different subnets. The router provides connectivity between hosts A and C by acting as the default gateway and routing packets.

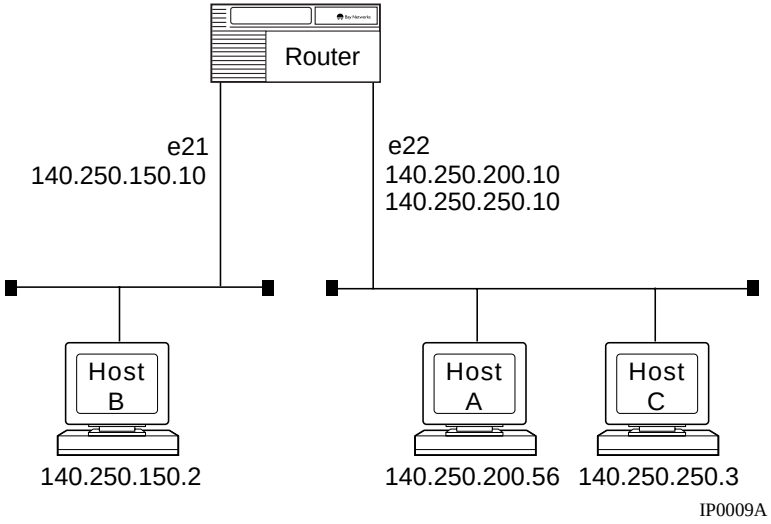


**Figure 4-2. Multinet Configuration**

## Disabling and Reenabling an IP Interface

When you configure an IP interface on a circuit, the interface is automatically enabled. You can use the BCC or Site Manager to change the state of the IP interface as required.

### *Using the BCC*

Navigate to an IP interface-specific prompt and enter:

**state** <*state*>

*state* is one of the following:

**enabled** (default)
**disabled**

For example, the following command disables IP interface 2.2.2.2:

```
ip/2.2.2.2# state disabled
ip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-29. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying a Broadcast Address for an Interface

In broadcasting, the IP router transmits a single packet to every host on an attached network. To do so, it uses a broadcast address that refers to all hosts on the network. A broadcast address is simply an IP address that contains all 1s or all 0s in the host portion.

For example, the IP Class C address 10.3.45.12 has the following characteristics:

- Because the address is for a Class A network (the network portion is 1 byte), the host portion contains 3 bytes.
- Because the host portion of a broadcast address consists of all 1s or all 0s, the broadcast address for that network can be one of the following: 10.255.255.255, 10.0.0.0, 255.255.255.255, or 0.0.0.0.

Some networks do not support broadcasts; thus, configuring an IP broadcast address does not guarantee efficient broadcast delivery.

By default, IP uses a broadcast address that contains all 1s in the host portion.

Accept the default unless the calculated broadcast address (host portion) of all 1s is not adequate. If this is the case, then use the BCC or Site Manager to enter the appropriate IP broadcast address in dotted-decimal notation.

### *Using the BCC*

Navigate to an IP interface-specific prompt and enter:

**broadcast** *<broadcast_address>*

*broadcast_address* is an IP addressed expressed in dotted-decimal notation.

For example, the following command assigns broadcast address 1.1.1.1 to IP interface 2.2.2.2.

```
ip/2.2.2.2# broadcast 1.1.1.1
ip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Broadcast Address** parameter. Click on **Help** or see the parameter description on page A-30. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying a Subnet Broadcast Address

You configure a broadcast address for a subnet differently from the way you configure a broadcast address for a network. When you extend the network portion of the IP address to create a subnet address, you automatically take away from the host portion of the address. To configure a subnet broadcast, you take the subnet mask for that subnet and invert it. For example, if the IP address of the subnet is 10.4.2.3, and the mask is 255.255.0.0, then the subnet broadcast address is either 10.4.255.255 or 10.4.0.0.

## Specifying the Cost of an Interface

Each IP interface has an assigned cost. The interface cost is added to routes learned on this interface through RIP and is specified in subsequent RIP packets transmitted out other interfaces.

If the interface is configured for RIP, keep in mind that increasing the cost causes the upper bound set by the RIP Network Diameter parameter to be attained more rapidly.

By default, an IP interface has a cost of 1. You can use the BCC or Site Manager to specify another value as required.

### *Using the BCC*

Navigate to an IP interface-specific prompt and enter:

**cost** <*cost*>

*cost* is an integer indicating the cost of interface.

For example, the following command assigns a cost of 2 to IP interface 2.2.2.2:

```
ip/2.2.2.2# cost 2
ip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Cost** parameter. Click on **Help** or see the parameter description on page A-30. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Enabling MTU Discovery on an Interface

A probe MTU is a request for the maximum transmission unit (MTU) size used on all networks an IP datagram must traverse from source to destination.

By configuring IP to respond to probe MTUs on this interface, you eliminate transit fragmentation and destination reassembly for datagrams destined for this interface and, therefore, decrease network load.

The reply MTU and the probe MTU are options 11 and 12 in RFC 1063.

By default, IP does not respond to probe requests. You can use the BCC or Site Manager to turn this feature on and off as required.

### *Using the BCC*

Navigate to an IP interface-specific prompt and enter:

**mtu-discovery** *<state>*

*state* is one of the following:

**on**
**off** (default)

For example, the following command causes IP to respond to Probe MTUs on interface 2.2.2.2:

```
ip/2.2.2.2# mtu-discovery on
ip/2.2.2.2#
```

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **MTU Discovery** parameter. Click on **Help** or see the parameter description on page A-31. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Enabling and Disabling ICMP Address-Mask Replies

You can configure IP to generate ICMP (Internet Control Message Protocol) address-mask reply messages on this interface in response to valid address-mask request messages. The interface generates ICMP address-mask reply messages in compliance with the relevant sections of RFCs 950 and 1009.

By default, IP does not generate address-mask reply messages. You can use the BCC or Site Manager to turn this feature on and off as required.

### *Using the BCC*

Navigate to an IP interface-specific prompt and enter:

**mask-reply** *<state>*

*state* is one of the following:

**on**
**off** (default)

For example, the following command causes IP to send address-mask reply messages on interface 2.2.2.2:

```
ip/2.2.2.2# mask-reply on
ip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Addr Mask Reply** parameter. Click on **Help** or see the parameter description on page A-31. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Disabling and Reenabling ICMP Redirect Messages

An ICMP redirect is a message sent by the router to alert a host that it should be using a different path to route data.

In some cases, you do not want an interface to send out redirects. For example, in a frame relay network, two stations on the same network may not be directly connected if the network is not fully meshed. Thus, in this case, you would disable redirects on this interface.

By default, IP sends ICMP redirect messages. You can use the BCC or Site Manager to disable and reenable this feature on an IP interface as required.

### *Using the BCC*

Navigate to an IP interface-specific prompt and enter:

**redirects** *<state>*

*state* is one of the following:

**on** (default)
**off**

For example, the following command turns off ICMP redirect messages on IP interface 2.2.2.2:

```
ip/2.2.2.2# redirects off
ip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Redirect** parameter. Click on **Help** or see the parameter description on page A-35. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Enabling All-Subnet Broadcasting on an Interface

An all-subnet broadcast (ASB) datagram has a destination address equal to the broadcast address for an entire network (all subnets). For example, if a network interface serves the subnet 128.10.2.1 with a subnet mask of 255.255.255.0, the IP router considers any datagram with a destination address of 128.10.255.255 or 128.10.0.0 to be an ASB datagram.

By default, IP does not flood ASB datagrams. You can use the BCC or Site Manager to turn this feature on and off as required.

### *Using the BCC*

Navigate to an IP interface-specific prompt and enter:

**all-subnet-broadcast** *<state>*

*state* is one of the following:

**on**
**off** (default)

For example, the following command causes IP to flood ASB datagrams out interface 2.2.2.2:

```
ip/2.2.2.2# all-subnet-broadcast on
ip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **ASB** parameter. Click on **Help** or see the parameter description on page A-32. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Disabling UDP Checksum Processing on the Interface

By default, UDP checksum processing is enabled on this interface. All outgoing and incoming UDP datagrams are subject to checksum processing. You can use the BCC or Site Manager to turn this feature on an off as required.

### *Using the BCC*

Navigate to an IP interface-specific prompt and enter:

**udp-checksum** *<state>*

*state* is one of the following:

**on** (default)
**off**

For example, the following command turns off UDP checksum processing on IP interface 2.2.2.2:

```
ip/2.2.2.2# udp-checksum off
ip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Udp Xsum On** parameter. Click on **Help** or see the parameter description on page A-34. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

Use the default in virtually all instances. Disable UDP checksum processing to provide backward compatibility with UNIX BSD 4.1.

## Specifying a MAC Address or E.164 Address

You can use Site Manager to specify a MAC address or an E.164 address for this interface.

Table 4-3 shows the valid settings for the MAC address parameter.

**Table 4-3. MAC Address Parameter Settings**

| Value | Meaning |
|---|---|
| 0 | The IP router uses its IP address and the circuit's MAC address when transmitting packets on this interface. |
| User-specified MAC address | The IP router uses its IP address and this MAC address when transmitting and receiving packets on this interface. |
| E.164 address | If the interface is on an SMDS circuit, by default IP uses the individual SMDS-configured address. You can enter the entire E.164 address -- for example, C1 617 555 5000 FFFF. |

To configure this parameter for a multinet or multigroup configuration, refer to *Configuring SMDS.*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **MAC Address** parameter. Click on **Help** or see the parameter description on page A-34. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Enabling Source Routing over a Token Ring Network

The IP router can route over token ring networks that contain one or more source routing bridges.

In a source routing network, every end station that sends a frame supplies the frame with the necessary route descriptors so that it can be source routed across the network. Thus, in order for IP routers to route packets across a source routing network, *they must act like end stations*, supplying route descriptors for each packet before they send it onto the network.

With end-node support enabled, an IP router does the following:

1. Receives a packet and determines that the packet's next hop is located across a source routing network
2. Adds the necessary routing information field (RIF) information to the packet's MAC header
3. Sends the packet onto the network where it is source routed toward the next hop

Upon receiving the packet from the token ring network, the peer router strips off the RIF and continues to route the packet toward the destination network address (Figure 4-3).

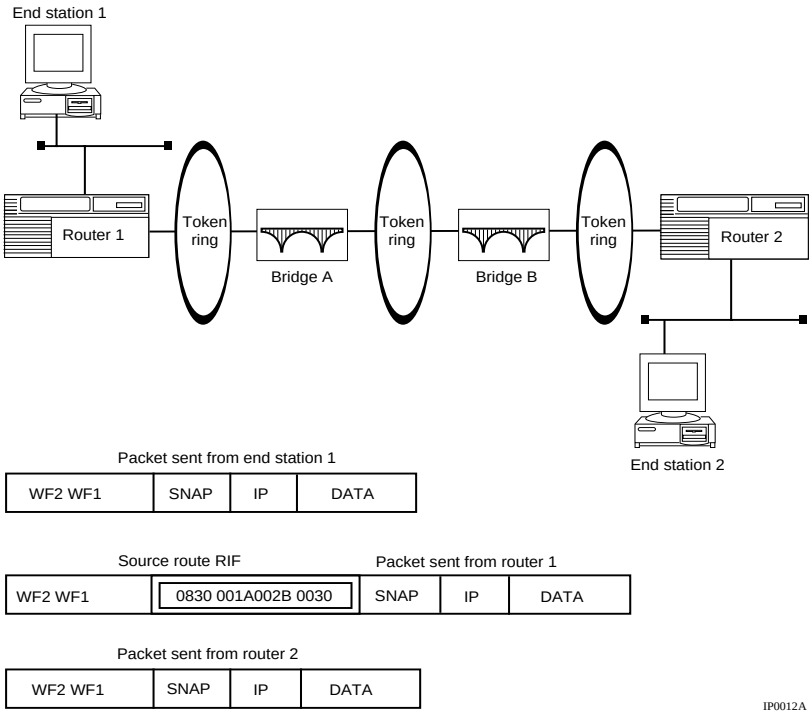


**Figure 4-3. IP Routers Source Routing Across a Token Ring Network**

The router can send ARP packets over an interface configured for a token ring network. Bay Networks supports both spanning tree explorer (STE) and all route explorer (ARE) ARP packets.

You can use the following Site Manager procedure to configure source route end-node support on a per-circuit basis and choose STE or ARE ARP packets.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the following parameters:<br>• **TR Endstation**<br>• **TR Endstation ARP Type**<br>Click on **Help** or see the parameter descriptions beginning on page A-35. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Configuring an SMDS Address

By default, if the interface is connected to an SMDS network, IP uses the SMDS-configured addresses.

You can use Site Manager to supply the following:

- A complete SMDS E.164 address specified by the SMDS subscription agreement that you have with your SMDS provider
- An address-resolution multicast address for this IP interface in an SMDS network

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the following parameters:<br>• **SMDS Group Address**<br>• **SMDS Arp Request Address**<br>Click on **Help** or see the parameter descriptions beginning on page A-36. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Configuring a WAN Address for a Frame Relay Network

If an interface is connected to a frame relay network, you can use Site Manager to configure the following:

- A broadcast address. If you enter a value for the FRM Broadcast parameter, the frame relay switch, rather than the router, will broadcast the message.
- A multicast address for this IP interface that will send messages to all OSPF routers in a frame relay network. If you enter a value for the FRM Cast 1 DLCI parameter, the frame relay switch, rather than the router, will send the message to all OSPF routers.
- A multicast address for this IP interface that will send messages to all OSPF designated routers in a frame relay network. If you enter a value for the FRM Cast 2 DLCI parameter, the frame relay switch, rather than the router, will send the message to all OSPF designated routers.

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the following parameters:<br>• **FRM Broadcast**<br>• **FRM Cast 1 DLCI**<br>• **FRM Cast 2 DLCI**<br>Click on **Help** or see the parameter descriptions beginning on page A-37. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying the Maximum Size of the Forwarding Table

To minimize the amount of time it spends looking up routes, IP creates and maintains a cache of frequently used routes -- called a *forwarding table* or *cache* -- for each IP interface.

A forwarding table is a first in first out (FIFO) buffer. When a datagram arrives on an IP interface for forwarding, IP searches the forwarding table associated with the interface for the destination network.

If the search is successful, IP dispatches the datagram to the interface noted in the table entry.

If the search is unsuccessful, IP consults the routing table to get the same information, dispatches the datagram to the appropriate interface, and caches the information in the appropriate forwarding table -- either by appending information to the table (if the table is not full) or by overwriting the oldest, first-in table entry (if the table is full).

If IP flushes a route from the routing table, it also removes the route from the forwarding tables, thus ensuring that invalid routing information is not retained in interface-specific caches.

An interface that receives packets that are destined for a large number of different destinations may benefit from a larger forwarding table. The larger the number of entries, the more likely it is that the destination will already be in the forwarding table and the faster the route lookups will be for those destinations.

Keep in mind that configuring a forwarding table size that is larger than necessary reduces the total amount of memory usable by other applications. On the other hand, configuring a routing table too small can affect overall router performance. Check the number of cache hits and misses to determine the optimal size of the forwarding table. For debugging purposes, if you see the wfIpInterfaceCacheMisses statistic going up at a rapid rate, consider increasing the table size. However, an occasional cache miss does not warrant an increase in table size.

By default, IP allocates a cache for 128 destination entries on the interface. You can specify a different cache size.

### *Using the BCC*

Navigate to an IP interface-specific prompt and enter:

**cache-size** *<size>*

*size* is the number of destination entries in the cache.

For example, the following command causes IP to allocate a cache on interface 2.2.2.2 for 175 entries:

```
ip/2.2.2.2# cache-size 175
ip/2.2.2.2#
```

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Forward Cache Size** parameter. Click on **Help** or see the parameter description on page A-40. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Configuring an Interface for an ATM Logical IP Subnet

RFC 1577, “Classical IP and ARP over ATM,” is a specification for an administrative entity within an ATM network called a logical IP subnet (LIS). Bay Networks supports RFC 1577. For information about configuring IP interfaces on an ATM LIS, see *Configuring ATM Services.*

You can use the BCC or Site Manager to do the following:

- Specify the ATMARP mode: client or server. You must configure one ATMARP server for each logical IP subnet you define.
- Define the ATM address network prefix of the ATMARP server on your network. A complete ATM address consists of a network prefix and a user part.
- Define the user part (suffix) of the ATM address for the ATMARP server on your network. The user part suffix consists of a 6-byte end station identifier and a 1-byte selector field.
- Specify (for a client) the interval between registration refreshes.
- Specify (for a server) the duration for which the registration is valid.

### *Using the BCC*

To specify the ATMARP mode, navigate to an IP interface-specific prompt and enter:

**arp-mode** *<mode>*

*mode* is one of the following:

**client** (default)
**arp**

To specify the address of an ATM server, navigate to an IP interface-specific prompt and enter:

**arp-server-address** *<address>*

*address* is a hexadecimal address.

To specify a server registration interval, navigate to an IP interface-specific prompt and enter:

**arp-server-reg-interval** *<interval>*

*interval* is one of the following:

**clientdefault**
**serverdefault**

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the following parameters:<br>• **ATM ARP Mode**<br>• **ARP Server ATM Address Network Prefix**<br>• **ARP Server ATM Address User Part**<br>• **Registration Refresh Interval**<br>Click on **Help** or see the parameter descriptions beginning on page A-41. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Configuring an Adjacent Host Address

An *adjacent host* is a device on a locally attached network. This device may or may not be a router. You must configure a MAC address for each adjacent host that does not implement ARP.

Also, if a local network does implement ARP, you may want to configure a MAC address for an adjacent host to preempt the ARP process.

You can use the BCC or Site Manager to configure an adjacent host.

### *Using the BCC*

To associate the IP address of an adjacent host with its physical address, navigate to the global IP prompt and enter one of the following:

**adjacent-host ip-address** *<ip_address>* **mac-address** *<physical_address>*

**adjacent-host ip-address** *<ip_address>* **vpi-vci** *<physical_address>*

**adjacent-host ip-address** *<ip_address>* **nsap** *<physical_address>*

**adjacent-host ip-address** *<ip_address>* **dlci** *<physical_address>*

**adjacent-host ip-address** *<ip_address>* **wan-address** *<physical_address>*

*physical_address* is the address you want to associate with the IP address (see Table 4-4).

BCC displays a prompt for the adjacent host. To set parameters that define the adjacent host, enter:

*<parameter> <value>*

*parameter value* is one of the parameter/value pairs listed in Table 4-4.

**Table 4-4. Adjacent Host BCC Parameters**

| Parameter | Value/Default | Description/Instructions |
|---|---|---|
| Enable | Enabled (default)<br>Disabled | Specifies the state of the adjacent host definition |
| IP address | No default | Specifies the IP address of the device for which you want to configure an adjacent host |
| MAC address | No default | Specifies the physical address of the adjacent host. Enter the MAC address as a 12-digit hexadecimal number. |
| VPI-VCI | No default | Specifies the physical address of the adjacent host. Enter an ATM/PVC address in the form virtual path identifier/virtual channel identifier -- for example, 0/32. |
| NSAP | No default | Specifies the physical address of the adjacent host |
| DLCI | No default | Specifies the physical address of the adjacent host |
| WAN address | No default | Specifies the physical address of the adjacent host |
| Encapsulation | Ethernet (default)<br>SNAP<br>Null | Specifies the adjacent host's encapsulation method. Select Ethernet or SNAP (Service Network Access Point) if you are defining a point-to-point network interface or if the adjacent host resides on an Ethernet. For an adjacent host on an ATM logical IP subnet, select SNAP. |
| Type | Default (default)<br>E164<br>X121 | Specifies the type of adjacent host |
| Sub-address | No default | Specifies the subaddress used to establish an SVC to the adjacent host |
| Type of Number | International (default)<br>Unknown | Specifies the type of number used to establish an SVC to the adjacent host |

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Adjacent Hosts**. | The IP Adjacent Hosts window opens. |
| 4. Click on **Add**. | The IP Adjacent Host Configuration window opens. |
| 5. Set the following parameters:<br>• **Enable**<br>• **Adjacent Host Address**<br>• **Next Hop Interface Addr**<br>• **MAC Address**<br>• **Host Encapsulation**<br>• **Adjacent Host X.121 Address**<br>• **Remote Party Sub-Address**<br>• **Remote Party Type of Number**<br>• **Adjacent Host Type**<br>Click on **Help** or see the parameter descriptions beginning on page A-54. | |
| 6. Click on **OK**. | The IP Adjacent Hosts window displays the adjacent host you just configured. |
| 7. Set the following parameters:<br>• **Enable**<br>• **Next Hop Interface Addr**<br>Click on **Help** or see the parameter descriptions beginning on page A-54. | |
| 8. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Defining a Static Route

A *static route* is a manually configured route that specifies the transmission path a datagram must follow, based on the datagram's destination address. A static route specifies a transmission path to another network. You configure a static route if you want to restrict datagrams to paths you specifically configure.

Static routes remain in IP routing tables until you remove them. Note, however, that if the interface that was used to reach the next hop in the static route becomes disabled, the static route disappears from the IP routing table.

You can use the BCC or Site Manager to specify the following:

- The state (active or inactive) of the static route record in the IP routing tables.
- The IP address of the network to which you want to configure the static route.
- The subnet mask of the destination network.
- The number of router hops a datagram can traverse before reaching the destination IP address. The IP router uses the cost value when determining the best route for a datagram to follow.
- The IP address of the next-hop router.
- The subnet mask of the next-hop router.
- A weighted value (from 1 to 16, with 16 being the most preferred) that the IP router uses to choose a route when its routing tables contain multiple routes to the same destination.
- The local router circuit associated with the static route over an unnumbered interface.

IP supports multiple static routes to the same destination. IP uses the best route to forward packets, and treats the other routes as backup routes in case the chosen route becomes unusable or is no longer considered the best route.

You can also configure IP to support equal-cost multipath (ECMP) routes for traffic load balancing. If IP considers the ECMP routes to be the best routes, IP uses them all in the way you specify -- in round-robin fashion, for example -- to forward data. For information, see "Enabling Equal-Cost Multipath Support" on page 4-18. With ECMP enabled globally on the router, you can configure up to 12 ECMP static routes.

**Note:** When you dynamically create a new static route (for example, 128.10.8.0/255.255.255.0/1), the router can generate the following error message in the router log file:

```
# 2: 04/16/98 09:44:24.096 WARNING SLOT 5 IP Code: 56
Error when configuring static route 128.10.8.0/255.255.255.0/1
```

This message indicates that the static route is not configured at the time stated because all necessary MIB sets are not completed. Error checking occurs as each attribute is set. The router code generates the error messages to prevent misconfigured static routes. You can verify that a static route has been created correctly by issuing a **get** command for the valid attribute in the wfIpStaticRouteEntry.10.* instance.

### *Using the BCC*

Navigate to the global IP prompt and enter:

**static-route address** *<destination>* **mask** *<ip_mask>* **next-hop-address** *<next_hop>*

*destination* is the destination IP address.

*ip_mask* is the mask the of destination IP address.

*next_hop* is the next-hop IP address.

The static route prompt appears.

The BCC configures a static route with default values for all static route parameters and displays a static-route-specific prompt. You customize a static route by modifying static route parameters. Navigate to the static-route-specific prompt and enter

*<parameter> <value>*

*parameter value* is one of the parameter/value pairs described in Table 4-5.

**Table 4-5. BCC Static Route Parameters**

| Parameter | Values/Defaults | Meaning/Instructions |
|---|---|---|
| State | Enabled (default)<br>Disabled | Specifies the state (active or inactive) of the static route record in the IP routing tables. Select Disable to make the static route record inactive in the IP routing table; the IP router will not consider this static route. Select Enable to make the static route record active again in the IP routing table. |

*(continued)*

**Table 4-5. BCC Static Route Parameters** *(continued)*

| Parameter | Values/Defaults | Meaning/Instructions |
|---|---|---|
| Address | The destination IP address you supplied when you configured the static route. You cannot modify this address. | Specifies the IP address of the network to which you want to configure the static route. Specifies a supernet for which you want to configure a black hole static route. Enter the destination IP address in dotted-decimal notation. To configure a default route, enter 0.0.0.0. To configure a black hole static route, enter a supernet address. You can configure up to 12 static routes to the same destination. |
| Mask | The destination IP address mask you supplied when you configured the static route. You cannot modify this address mask. | Specifies the subnet mask of the destination network. Specifies the supernet mask of the supernet for which you want to configure a black hole static route. Enter the subnet or supernet mask in dotted-decimal notation. To configure a default route, enter 0.0.0.0. To configure a black hole static route, enter a supernet mask. |
| Next Hop Address | The next-hop IP address mask you supplied when you configured the static route. You cannot modify this address mask.s | Specifies the IP address of the next-hop router. Defines a black hole route for a supernet. Enter the IP address in dotted-decimal notation. To configure a black hole static route, enter 255.255.255.255. If you are configuring a static route to an unnumbered interface, enter 0.0.0.0. |
| Next Hop Mask | IP address mask | Specifies the subnet mask of the next-hop router. |

*(continued)*

**Table 4-5. BCC Static Route Parameters** *(continued)*

| Parameter | Values/Defaults | Meaning/Instructions |
|---|---|---|
| Cost | 1 (default)<br>to RIP diameter | Specifies the number of router hops a datagram can traverse before reaching the destination IP address. The IP router uses the cost value when determining the best route for a datagram to follow. If you have enabled ECMP on the router (for information, see “Enabling Equal-Cost Multipath Support” on page 4-18), you can configure up to 12 equal-cost static routes. |
| Preference | i (default))<br>to 16 | Specifies a weighted value (from 1 to 16, with 16 being the most preferred) that the IP router uses to select a route when its routing tables contain multiple routes to the same destination.To configure a black hole static route, enter the maximum preference value. |

For example, the following command line configures a static route to destination 3.2.4.5/255.255.0.0 with default values for static route parameters. The next-hop address is 2.2.2.4, and the cost is set to four hops.

```
ip# static-route address 3.2.4.5 mask 255.255.0.0 next-hop-address 2.2.2.4
static-route/3.2.4.5/255.255.0.0/2.2.2.4# cost 4
static-route/3.2.4.5/255.255.0.0/2.2.2.4#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Static Routes**. | The IP Static Routes window opens. |
| 4. Click on **Add**. | The IP Configuration window opens. |
| 5. Set the following parameters:<br>• **Destination IP Address**<br>• **Address Mask**<br>• **Cost**<br>• **Next Hop Addr**<br>• **Next Hop Mask**<br>• **Preference**<br>• **Unnumbered CCT Name**<br>Click on **Help** or see the parameter descriptions beginning on page A-51. | |
| 6. Click on **OK**. | Site Manager returns you to the IP Static Routes window. |

## Defining a Static Default Route

If IP receives a data packet with a destination address that it is unable to match in its routing table, it looks for a default route that it can use to forward the packet.

To include a default route in the routing table, create a static route with a destination address of 0.0.0.0. For the next-hop address, specify a router that can forward the packet to its destination.

## Defining a Static Black Hole for a Supernet

A router that advertises an aggregate route by using a supernet address to represent multiple explicit routes must be able to discard packets that match the supernet address but that do not match any of the explicit routes.

For example, consider a router that advertises an aggregate route using the supernet address 192.32.0.0/255.255.248. The supernet address represents eight specific networks: 192.32.0.0 to 192.32.7.0. Once the aggregate route has been propagated, the router receives network traffic for each of these specific destinations.

At some point, the router loses connectivity to network 192.32.3.0, one of the networks in the supernet. The router continues to forward traffic that matches destinations 0.0 to 2.0 and 4.0 to 7.0. However, the router can no longer find a complete match in the routing table for the disconnected network, 3.0. The router must drop all traffic destined for 192.32.3.0.

To force the router to drop the packet for an unmatched destination, you configure a special type of static route for a supernet called a *black hole.* To do so:

- Enter the supernet address/mask pair as the destination IP address and address mask.
- To create the black hole, enter the black hole encoding (255.255.255.255) as the next-hop address and the next-hop mask.

# Configuring and Customizing Router Discovery

Before a host can send IP datagrams beyond its directly attached subnet, the host must discover the address of at least one operational router on that subnet. Router Discovery is an extension of the Internet Control Message Protocol (ICMP) that enables hosts attached to multicast or broadcast networks to discover the IP addresses of their neighboring routers.

Routers configured with Router Discovery periodically multicast or broadcast a router advertisement from each of their interfaces, announcing the IP address or addresses of that interface. Hosts discover the addresses of their neighboring routers by listening for these advertisements. Hosts will use the router with the highest preference level as a gateway.

By default, Router Discovery is enabled on each IP interface. You can use the BCC or Site Manager to choose the operating characteristics of Router Discovery on the interface, as described under the following topics:


| Topic | Page |
|---|---|
| Enabling and Disabling Router Discovery | 4-64 |
| Choosing a Broadcast Type | 4-64 |
| Specifying a Minimum Time Interval Between Advertisements | 4-65 |
| Specifying a Maximum Time Interval Between Advertisements | 4-65 |
| Configuring the Lifetime of Advertised Addresses | 4-66 |
| Specifying Interface Preference | 4-66 |

## Enabling and Disabling Router Discovery

You can use Site Manager to enable and disable Router Discovery on an interface.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Router Discovery**. | The IP Router Discovery window opens. |
| 4. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-67. | |
| 5. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Choosing a Broadcast Type

You can use Site Manager to specify the type of broadcast to use in sending advertisements. You should use multicast (the default broadcast type) wherever possible; that is, on any link where all listening hosts support IP multicast.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Router Discovery**. | The IP Router Discovery window opens. |
| 4. Set the **Broadcast Type** parameter. Click on **Help** or see the parameter description on page A-67. | |
| 5. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying a Minimum Time Interval Between Advertisements

You can use Site Manager to specify the minimum number of seconds between advertisements.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Router Discovery**. | The IP Router Discovery window opens. |
| 4. Set the **Minimum Interval** parameter. Click on **Help** or see the parameter description on page A-67. | |
| 5. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying a Maximum Time Interval Between Advertisements

You can use Site Manager to specify the maximum number of seconds between advertisements.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Router Discovery**. | The IP Router Discovery window opens. |
| 4. Set the **Maximum Interval** parameter. Click on **Help** or see the parameter description on page A-68. | |
| 5. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Configuring the Lifetime of Advertised Addresses

You can use Site Manager to specify the maximum length of time that advertised addresses are to be considered as valid router addresses by hosts, in the absence of further advertisements.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Router Discovery**. | The IP Router Discovery window opens. |
| 4. Set the **Lifetime** parameter. Click on **Help** or see the parameter description on page A-68. | |
| 5. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying Interface Preference

You can use Site Manager to specify the preferability (a higher number indicates more preferred) of the address as a default router address, relative to other router addresses on the same subnet.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Router Discovery**. | The IP Router Discovery window opens. |
| 4. Set the **Interface Preference** parameter. Click on **Help** or see the parameter description on page A-68. | |
| 5. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Chapter 5
# Configuring Address Resolution

You configure address resolution by setting parameters as described under the following topics:


| Topic | Page |
|---|---|
| ARP Overview | 5-2 |
| Enabling and Disabling Global ARP | 5-4 |
| Customizing Global ARP Characteristics | 5-5 |
| Selecting an Address Resolution Scheme for an IP Interface | 5-6 |
| Selecting an Encapsulation Option for ARP and Probe | 5-8 |
| Enabling Proxy ARP on an Interface | 5-9 |
| Timing Out Entries in the Address Resolution Cache | 5-11 |

# ARP Overview

The IP router needs both a physical address and an IP address to transmit a datagram. In situations where the router knows only the network host's IP address, the Address Resolution Protocol (ARP) enables the router to determine a network host's physical address by binding a 32-bit IP address to a 48-bit MAC address. A router can use ARP across a single network only, and the network hardware must support physical broadcasts.

For example, in Figure 5-1, the router and host C are on the same physical network. Both devices have an assigned IP address (the router's is 140.250.200.1 and host C's is 140.250.200.4) and both devices have an assigned physical address (the router's is 00 00 A2 00 00 01 and host C's is 00 00 A2 00 10 40).

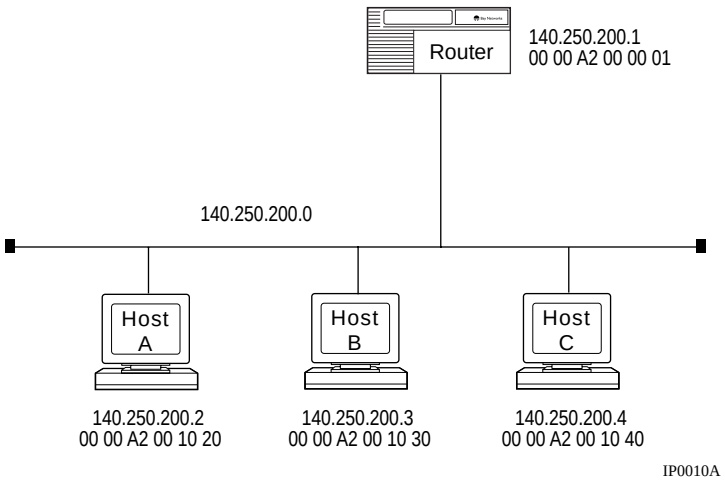


**Figure 5-1. ARP Example**

In Figure 5-1, the router wants to send a packet to host C but knows only host C's IP address. The router uses ARP to determine host C's physical address, as follows:

1. The router broadcasts a special packet, called an ARP request, that asks IP address 140.250.200.4 to respond with its physical address.
2. All network hosts receive the broadcast request.
3. Only host C responds with its hardware address.

The router maps host C's IP address (140.250.200.4) to its physical address (00 00 A2 00 10 40) and saves the results in an address-resolution cache for future use.

**Note:** The router can send out ARP requests even if ARP, which is a dynamically loaded module, is not currently loaded on the router. As the network administrator, you must ensure that ARP is loaded correctly on a slot. To do this through Site Manager, choose Events Manager > Options > Filters; then select LOADER and Debug, and choose File > Get Current Log File. Verify that ARP is loaded on a slot by locating the following message in the log:

```
#xx:01/01/95 10:10:55.00 DEBUG SLOT x LOADERCODE:33
Loader service completed for ARP.EXE 0xxxxxxxxx
```

# Enabling and Disabling Global ARP

ARP is configured and enabled on the router at startup. You can use the BCC to disable and reenable ARP as required.

Navigate to the global IP prompt and enter:

**arp**

The global ARP prompt appears.

Enter:

**state** *<state>*

*state* is one of the following:

**enabled** (default)
**disabled**

For example, the following command sequence disables ARP on the router:

```
ip# arp
arp# state disabled
arp#
```

# Customizing Global ARP Characteristics

You can use the BCC or Site Manager to do the following:

- Control how ARP acts in relation to IP's forwarding state.
- Control whether IP drops and logs an invalid ARP source address or simply drops the request.
- Control whether IP drops or accepts ARP requests in which the source and destination addresses are located in different networks or subnetworks. This parameter allows Proxy ARP to generate replies when the source and destination networks in the ARP request differ.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the following parameters:<br>• **ARP Forwarding**<br>• **Nonlocal ARP Source**<br>• **Nonlocal ARP Destination**<br>Click on **Help** or see the parameter descriptions beginning on page A-44. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

# Selecting an Address Resolution Scheme for an IP Interface

In addition to ARP, IP supports Inverse ARP, HP Probe, and X.25 address resolution schemes as follows:

- Inverse ARP provides address resolution for frame relay interfaces. Use Inverse ARP to discover the IP address of the station at the remote end of the virtual circuit.
- HP Probe, a Hewlett-Packard proprietary protocol, is an address resolution mechanism that functions much like ARP to determine a network host's physical address using the host's IP address by binding a 32-bit IP address to a 48-bit MAC address. IP supports HP Probe over Ethernet and the following HP Probe messages:
  - -- Unsolicited Reply (incoming and outgoing)
  - -- Name Request (incoming)
  - -- Name Reply (outgoing)
  - -- Virtual Address Reply (incoming and outgoing)
  - -- Virtual Address Request (incoming and outgoing)
  - -- Proxy Request (incoming and outgoing)
  - -- Proxy Reply (incoming and outgoing)

**Note:** If bridging is configured and enabled on the interface (in addition to IP), the Name Request/Reply and the Proxy Request/Reply messages are bridged.

IP can support the concurrent operation of HP Probe and ARP on an interface.

- The X.25 address resolution scheme is used on network interfaces that support the X.25 DDN service.
- The RFC 877-compliant address-resolution mechanism is used on network interfaces that support the X.25 PDN service.

On interfaces configured for a token ring network, the router can send ARP requests as Spanning Tree Explorer (STE) packets or All-Routes Explorer (ARE) packets.

By default, ARP is enabled on the interface. You can use the BCC or Site Manager to specify an address resolution scheme.

### *Using the BCC*

Navigate to an IP interface-specific prompt and enter:

**address-resolution** *<type>*

*type* is one of the following:

**arp** (default)
**ddn**
**pdn**
**inarp**
**arpinarp**
**none**
**bfeddn**
**probe**
**arpprobe**
**atmarp**

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Address Resolution Type** parameter. Click on **Help** or see the parameter description on page A-32. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Selecting an Encapsulation Option for ARP and Probe

If you select ARP, Probe, or ARP/Probe, you must also select the appropriate datalink encapsulation option as follows:

- If your address-resolution scheme is ARP only, select Ethernet encapsulation, SNAP encapsulation, or Ethernet/SNAP encapsulation.
- If your resolution scheme is HP Probe only, select LSAP encapsulation.
- If your resolution scheme is ARP/Probe, select Ethernet/LSAP encapsulation, SNAP/LSAP encapsulation, or Ethernet/SNAP/LSAP encapsulation.

IP ignores this parameter if the underlying medium is anything other than Ethernet.

By default, IP uses ARP Ethernet encapsulation. You can use the BCC or Site Manager to specify an encapsulation scheme.

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Ethernet Arp Encaps** parameter. Click on **Help** or see the parameter description on page A-36. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Enabling Proxy ARP on an Interface

Proxy ARP allows a router to answer a local ARP request for a remote destination. For example, in Figure 5-2, hosts B and C are located on the same network but on separate subnetworks. Hosts B and C do not understand subnetworking. The router connecting the two physical networks knows which host resides on which network. The address mask is 255.255.255.000. In this example, one subnet is a remote network with respect to the other subnet.

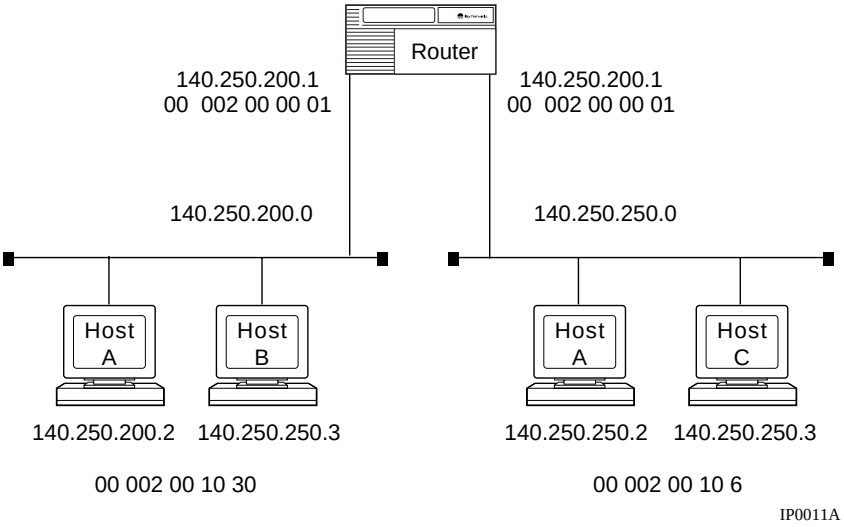


**Figure 5-2. Proxy ARP Example**

Host B wants to talk to host C, so host B broadcasts an ARP request, which asks IP address 140.250.250.3 to respond with its physical address. The router captures host B's ARP request and responds with its hardware address 00 002 00 00 01 and host C's IP address 140.250.250.3. Host B maps host C's IP address 140.250.250.3 to the router's hardware address 00 002 00 00 01.

With Proxy ARP enabled, the router will respond with an ARP reply if there is a valid route (that is, if the router is able to forward traffic) to the destination in the routing table. This route may be a subnet route or a default route. For the router to respond for subnets that are reachable via the default route, you must configure IP to use a default route for unknown subnets (see "Using a Default Route for an Unknown Subnet" on page 4-15).

Some devices use Proxy ARP to determine a gateway rather than relying on a statically defined default gateway. These devices will use ARP for all remote destinations. To enable the router to reply to ARP for remote destinations on other networks, you must enable Proxy ARP and set the Nonlocal ARP Destination parameter to Accept (see "Customizing Global ARP Characteristics" on page 5-5).

By default, Proxy ARP is disabled on the interface. You can use the BCC or Site Manager to enable Proxy ARP.

### *Using the BCC*

Navigate to the IP interface-specific prompt and enter:

**proxy** *<state>*

*state* is one of the following:

**on**
**off**

For example, the following command turns on Proxy ARP on IP interface 2.2.2.2:

```
ip/2.2.2.2# proxy on
ip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Proxy** parameter. Click on **Help** or see the parameter description on page A-33. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Timing Out Entries in the Address Resolution Cache

IP maintains an address resolution cache on each interface that is configured with ARP or Proxy Arp. The address resolution cache contains host physical addresses learned by means of ARP or Proxy ARP.

If you enable the cache timeout feature on this interface, the IP router removes address resolution cache entries that have not been accessed within a specified number of seconds. Once an entry is removed, the IP router must use ARP to reacquire the physical-level address.

A host entry is timed out (deleted) if the IP router sends no traffic destined for that host within the specified timeout period.

By default, the cache timeout feature is disabled on the interface. You can use the BCC or Site Manager to enable the feature and to specify a timeout interval (in seconds).

### *Using the BCC*

Navigate to the IP interface-specific prompt and enter:

**aging** *<action>*

*action* is one of the following:

**cacheoff** (default)
**cache120**
**cache180**
**cache240**
**cache300**
**cache600**
**cache900**
**cache1200**

For example, the following command causes IP to time out entries from the address resolution cache on IP interface 2.2.2.2 after 300 seconds:

```
ip/2.2.2.2# aging cache300
ip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interface List window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interface List window. |
| 5. Set the **Host Cache** parameter. Click on **Help** or see the parameter description on page A-33. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Chapter 6
# Customizing RIP Services

You customize the Routing Information Protocol (RIP) by setting RIP parameters as described under the following topics:


| Topic | Page |
|---|---|
| Customizing RIP Global Parameters | 6-2 |
| Customizing a RIP Interface | 6-4 |
| Configuring RIP Accept and Announce Policies | 6-29 |

# Customizing RIP Global Parameters

When you add RIP to an IP interface, RIP is enabled on the router with default values for all global parameters. You customize the way RIP operates on the router by modifying RIP global parameters as described in the following sections.

### *Using the BCC*

Navigate to the IP global prompt and enter:

**rip**

The RIP global prompt appears.

## Setting the RIP Diameter

The *RIP diameter* is a hop count that RIP uses to denote infinity. For RIP to operate properly, every router within the network must be configured with an identical RIP diameter value. If RIP is enabled, this parameter specifies the maximum number of hops within the autonomous system; if RIP is not enabled, IP still uses the RIP diameter to determine network width.

You must set this parameter so that the interface cost, static cost, or route filter cost parameters do not exceed the RIP diameter. We recommend that you accept the default RIP diameter value.

The default RIP diameter value is 15 hops. You can use the BCC or Site Manager to specify a different RIP diameter value.

### *Using the BCC*

Navigate to the global IP prompt and enter:

**rip-diameter** *<infinity>*

*infinity* is a hop count indicating RIP infinity.

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Global**. | The Edit IP Global Parameters window opens. |
| 4. Set the **RIP Diameter** parameter. Click on **Help** or see the parameter description on page A-46. | |
| 5. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

# Customizing a RIP Interface

When you add RIP to an IP interface, RIP is enabled with default values for all parameters. You customize RIP on the interface by modifying parameters as described in the following topics:


| Topic | Page |
|---|---|
| Navigating the BCC to a RIP Interface Prompt | 6-5 |
| Opening the Site Manager Window for RIP Interfaces | 6-6 |
| Disabling and Reenabling RIP on an Interface | 6-7 |
| Selecting the RIP Version | 6-8 |
| Supplying RIP Updates on an Interface | 6-10 |
| Specifying the Update Mode | 6-11 |
| Sending Triggered Updates | 6-12 |
| Specifying a Time-to-Live Value | 6-14 |
| Receiving RIP Updates on an Interface | 6-16 |
| Authenticating the Password on a Version 2 Update | 6-17 |
| Supplying a Default Route on an Interface | 6-19 |
| Listening for a Default Route | 6-21 |
| Configuring a RIP Interface for Dial-Optimized Routing | 6-22 |
| Setting RIP Timers on an Interface | 6-22 |

## Navigating the BCC to a RIP Interface Prompt

Beginning at the prompt for an IP interface that you have configured on the router, enter:

**rip**

A RIP interface-specific prompt appears.

To display the current (default) values for RIP interface parameters, enter:

**info**

For example, the following command sequence invokes a RIP prompt for IP interface 2.2.2.2 and displays values for IP interface parameters:

```
ip/2.2.2.2/255.0.0.0# rip
rip/2.2.2.2# info
  on ip/2.2.2.2/255.0.0.0
  state enabled
  supply enabled
  listen enabled
  default-supply disabled
  default-listen disabled
  mode poisoned
  ttl 1
  broadcast-timer 30
  timeout-timer 90
  holddown-timer 90
  version rip1
  triggered-updates disabled
  authentication-type none
  authentication {}
  frsvc disabled
rip/2.2.2.2#
```

## Opening the Site Manager Window for RIP Interfaces

Use the following Site Manager procedure to open the RIP Interfaces window and choose the interface whose parameters you want to inspect:

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want to enable. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |

## Disabling and Reenabling RIP on an Interface

You can use the BCC or Site Manager to change the state of RIP on the interface as required.

### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**state** <*state*>

*state* is one of the following:

**enabled** (default)
**disabled**

For example, the following command disables RIP on IP interface 2.2.2.2:

```
rip/2.2.2.2# state disabled
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want to enable. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-92. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Selecting the RIP Version

You can specify whether RIP sends Version 1 updates, Version 2 updates with no aggregation of subnets, or Version 2 updates with subnet aggregation.

- In RIP Version 1 mode (the default), RIP generates Version 1 updates only, using the broadcast address as specified in RFC 1058. RIP aggregates subnet information.
- In RIP Version 2 mode, RIP generates Version 2 updates, using the multicast address 224.0.0.9 as specified in the RIP Version 2 RFC, 1388. RIP does not aggregate subnet information.
- In RIP Version 2 mode with aggregation, RIP generates RIP Version 2 updates, using the multicast address, and performs aggregation of subnets into a natural network advertisement on interfaces belonging to another network.

In both Version 2 modes, RIP checks for a password on all received updates (see "Authenticating the Password on a Version 2 Update" on page 6-17).

By default RIP sends Version 1 updates. You can use the BCC or Site Manager to choose Version 2 with or without aggregation of subnet information.

### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**version** <*version*>

*version* is one of the following:

**rip1** (default)
**rip2**
**aggr**

For example, the following command causes RIP to send Version 2 updates with aggregation of subnets:

```
rip/2.2.2.2# version aggr
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **RIP Mode** parameter. Click on **Help** or see the parameter description on page A-97. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Supplying RIP Updates on an Interface

By default, RIP supplies RIP updates to neighboring networks on each interface. You can use the BCC or Site Manager to disable and reenable this feature on an interface as required.

### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**supply** *<state>*

*state* is one of the following:

**enable** (default)
**disable**

For example, the following command causes RIP to stop supplying updates on IP interface 2.2.2.2:

```
rip/2.2.2.2# supply disable
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **RIP Supply** parameter. Click on **Help** or see the parameter description on page A-92. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying the Update Mode

RIP can issue routing updates in the following modes:

- Poisoned reverse (the default)
- Split horizon
- Actual cost

*Poisoned reverse* mode and *split horizon* mode are schemes for controlling the way a router advertises a route to the neighbor from which it learned the route.

In poisoned reverse updating, a router that sends updates to a neighbor includes routes learned from that neighbor but sets the route metric to infinity.

In split horizon updating, a router that sends updates to a neighbor omits routes that it learned from that neighbor.

On certain interfaces -- for example, on a frame relay interface that has virtual connections (VCs) to different routers that are part of the same logical IP subnet -- you may need to advertise all learned routes with the *actual cost*.

By default, RIP sends poisoned reverse updates. You can use the BCC or Site Manager to specify a different update mode.

### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**mode** *<mode>*

*mode* is one of the following:

**poisoned**
**actual**
**split**

For example, the following command causes RIP to send split-horizon updates on IP interface 2.2.2.2:

```
rip/2.2.2.2# mode split
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **Poisoned Reverse** parameter. Click on **Help** or see the parameter description on page A-94. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Sending Triggered Updates

RIP generates full routing updates at regular intervals. You can also configure RIP to generate an update on a specified interface each time it recalculates a route's metric. Such an update is called a *triggered update*. A triggered update contains only the routes that have changed. (RIP also sends full updates at regular intervals on interfaces configured for triggered updating.)

By default, triggered updates are disabled on all interfaces configured for RIP.

You can use the BCC or Site Manager to enable and disable triggered updates on this interface.

### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**triggered-updates** *<state>*

*state* is one of the following:

**enable**
**disable** (default)

For example, the following command enables triggered updates on IP interface 2.2.2.2:

```
rip/2.2.2.2# triggered-updates enable
rip/2.2.2.2#
```

### *Using Site Manager*

| **Site Manager Path** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **Triggered Updates** parameter. Click on **Help** or see the parameter description on page A-97. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying a Time-to-Live Value

By default, RIP inserts a time-to-live (TTL) value of 1 hop into each outbound routing update. Setting a TTL of 1 prevents RIP updates from inadvertently getting off the local network. Increasing the TTL introduces the risk of the update getting off the local network and being forwarded around the network.

Certain RIP implementations ignore packets with a TTL value of 1 hop. Use this parameter to provide interoperability with such implementations.

You can use the BCC or Site Manager to specify a TTL value greater than 1.

**Note:** For compatibility with routers running Version 8.10 or earlier, disable this feature. Implementations of RIP earlier than Version 9.00 do not support triggered updates.

### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**time-to-live** *<hops>*

*hops* is the time-to-live value (expressed as the number of hops) that RIP inserts in each outbound update.

For example, the following command causes RIP to insert a TTL value of 2 in each outbound update:

```
rip/2.2.2.2# time-to-live 2
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want to enable. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **Time to Live** parameter. Click on **Help** or see the parameter description on page A-95. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Receiving RIP Updates on an Interface

By default, RIP listens for routing updates on every interface on which it is enabled.

You can use the BCC or Site Manager to disable and reenable this feature as required.

### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**listen** *<state>*

*state* is one of the following:

**enable** (default)
**default**

For example, the following command causes RIP to stop listening for updates on IP interface 2.2.2.2:

```
rip/2.2.2.2# listen disable
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want. | The parameter values for that interface appear. |
| 6. Set the **RIP Listen** parameter. Click on **Help** or see the parameter description on page A-93. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Authenticating the Password on a Version 2 Update

By default, RIP running in RIP Version 2 mode does not authenticate the password on incoming updates. RIP checks for the presence of a password as follows:

- If no password is present, RIP accepts the update.
- If a password is present, RIP drops the update.

With authentication enabled, RIP drops all received Version 1 updates and processes only Version 2 updates in the following manner:

- If no password is present in the Version 2 update, RIP drops the update.
- If a password is present in the Version 2 update and that password is valid, RIP accepts the update.
- If the password is invalid, RIP drops the update.

You can use the BCC or Site Manager to configure a RIP interface for authentication and enable password checking. If you configure authentication on a RIP interface, you can assign the interface a 1-to-16-character password.

### *Using the BCC*

To configure authentication, navigate to a RIP interface-specific prompt and enter:

**authentication-type** *<type>*

*type* is one of the following:

**none** (default)
**simple**

To specify a password, enter:

**authentication** *<password>*

### *Using Site Manager*

| **Site Manager Path** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the following parameters:<br>• **Authentication Type**<br>• **Authentication Password**<br>Click on **Help** or see the parameter descriptions beginning on page A-98. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Supplying a Default Route on an Interface

When the routing table does not contain the route to a particular destination address, the router looks for a default route to the destination. Like any other route in the routing table, the default route can be acquired dynamically (by means of a routing protocol) or entered statically (by you).

This parameter is independent of the RIP Supply parameter. A configured policy can override the parameter.

By default, RIP does not supply a default route. You can use the BCC or Site Manager to configure RIP to advertise an existing default route (one that is present in the routing table) in RIP updates sent to neighboring networks. You can also configure RIP to generate a default route if the routing table does not contain a default route.

### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**default-supply** *<action>*

*action* is one of the following:

**enable**
**disable** (default)
**generate**

For example, the following command causes RIP to supply a default route on IP interface 2.2.2.2:

```
rip/2.2.2.2# default-supply enable
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **Default Route Supply** parameter. Click on **Help** or see the parameter description on page A-93. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Listening for a Default Route

By default, RIP ignores inbound advertisements of a default route on the interfaces where it is configured. You can use the BCC or Site Manager to configure RIP to listen for a default route.

### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**default-listen** *<action>*

*action* is one of the following:

**enable**
**disable** (default)

For example, the following command causes RIP to listen for a a default route on IP interface 2.2.2.2:

```
rip/2.2.2.2# default-listen enable
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **Default Route Listen** parameter. Click on **Help** or see the parameter description on page A-94. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Configuring a RIP Interface for Dial-Optimized Routing

Dial-optimized routing is a method of reducing costs on dialed lines. Under dial-optimized routing, RIP exchanges routing information on the interface only when the router or a peer has activated the connection for a data transmission. RIP does not initiate a connection on a dialed line solely for the purpose of issuing a routing update.

For information about enabling dial-optimized routing, see *Configuring Dial Services*.

Once you have enabled dial-optimized routing, you can use Site Manager to set RIP timers to control the way RIP generates updates on interfaces to dialed lines. For information on setting timers for dial-optimized routing, see the next section, "Setting RIP Timers on an Interface."

## Setting RIP Timers on an Interface

Configurable timers determine the way RIP manages route information on an interface. Setting these timers allows you to specify the following:

- The frequency at which RIP broadcasts full RIP updates on the interface
- The timeout period that RIP will wait before considering a network unreachable
- The holddown period that unreachable routes will be retained in the routing table and advertised

### Specifying an Update Interval

By default, RIP generates a full update every 30 seconds on each interface configured with RIP.

If you have enabled dial-optimized routing on this interface, the default is 1 hour.

You can use the BCC or Site Manager to specify an update interval for the interface.

### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**broadcast-timer** *<seconds>*

*seconds* is the broadcast interval in seconds (the default interval is 30 seconds).

For example, the following command causes RIP to broadcast a full update every 15 seconds on IP interface 2.2.2.2:

```
rip/2.2.2.2# broadcast-timer 15
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want to enable. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **Broadcast Timer** parameter. Click on **Help** or see the parameter description on page A-95. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

### Specifying a Timeout Period

By default, RIP waits 90 seconds for an update from a network before it considers that network to be unreachable.

If you have enabled dial-optimized routing on this interface, the default is 3 hours.

You can use the BCC or Site Manager to specify a timeout period between 15 seconds and 259,200 seconds (72 hours). For dial-optimized routing, the maximum value is 3,628,800 seconds (6 weeks).

#### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**timeout-timer** <*seconds*>

*seconds* is the timeout interval in seconds.

For example, the following command sets the RIP timeout timer to 120 seconds on IP interface 2.2.2.2:

```
rip/2.2.2.2# timeout-timer 120
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want to enable. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **Timeout Timer** parameter. Click on **Help** or see the parameter description on page A-95. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

### Specifying a Holddown Period

Once RIP has determined that a network is unreachable, RIP continues to advertise a route to that network for a default holddown period of 90 seconds.

If you have enabled dial-optimized routing on this interface, the default is 3 hours.

You can use the BCC or Site Manager to specify a holddown period between 15 seconds and 259,200 seconds (72 hours). For dial-optimized routing, the maximum value is 3,628,800 seconds (6 weeks).

#### *Using the BCC*

Navigate to a RIP interface-specific prompt and enter:

**holddown-timer** *<seconds>*

*seconds* is the holddown period expressed in seconds.

For example, the following command sets the holddown timer to 60 seconds on IP interface 2.2.2.2:

```
rip/2.2.2.2# holddown-timer 60
rip/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want to enable. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **Holddown Timer** parameter. Click on **Help** or see the parameter description on page A-96. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

### Specifying a Stabilization Time

The stabilization time is the period that RIP allows itself to learn all routes from its neighbors before sending full updates. By default, RIP uses a stabilization time of 120 seconds.

You can use Site Manager specify a stabilization time for this interface.

| Site Manager Path | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP menu opens. |
| 4. Choose **Interfaces**. | The IP RIP Interface Configuration window opens. |
| 5. Click on the RIP interface you want to enable. | The parameter values for that interface appear in the IP RIP Interface Configuration window. |
| 6. Set the **Initial Stabilization Timer** parameter. Click on **Help** or see the parameter description on page A-98. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Configuring RIP Accept and Announce Policies

RIP accept policies and announce policies allow you to control the flow of routing information in and out of the routing table as follows:

- An *accept policy* controls the routing information that is considered for inclusion in the IP routing table.
- An *announce policy* controls the routing information that RIP advertises.

For an introduction to IP policies, see “IP Routing Policies and Filters” on page 1-14.

The following topics show you how to configure RIP accept and announce policies:


| Topic | Page |
|---|---|
| Defining a RIP Accept Policy | 6-30 |
| Supplying Modification Values for a RIP Accept Policy | 6-33 |
| Specifying Matching Criteria for a RIP Accept Policy | 6-35 |
| Defining a RIP Announce Policy | 6-37 |
| Supplying Modification Values for a RIP Announce Policy | 6-40 |
| Specifying Matching Criteria for a RIP Announce Policy | 6-41 |

## Defining a RIP Accept Policy

To define a new RIP accept policy, you must do the following:

- Supply a name for the policy.
- Set the current state of the policy (enabled or disabled).
- Specify whether RIP accepts or ignores an update that matches the policy.
- Rank the policy according to preference, precedence, and other criteria.

You can use the BCC or Site Manager to define a RIP accept policy.

### *Using the BCC*

To define a new policy, navigate to the RIP global prompt and enter:

**accept** *<policy_name>*

*policy_name* is a unique name for the RIP accept policy.

A policy-specific prompt appears, indicating that the BCC has created the policy using default values for all parameters.

For example, the following command creates an accept policy named pol_1:

```
rip# accept pol_1
accept/pol_1/rip#
```

To customize a policy, enter:

*<parameter> <value>*

*parameter value* is one of the parameter/value pairs shown in Table 6-1.

**Table 6-1. BCC Definition Parameters for RIP Accept Policies**

| Parameter | Values | Function |
|---|---|---|
| state | Enabled (default)<br>Disabled | Enables and disables the policy you have created |
| action | Ignore (default)<br>Accept | Specifies whether the protocol ignores a route that matches the policy or forwards the route to the routing table manager |
| preference | 1 (default) to 16 | Assigns a metric value (the higher the number, the greater the preference) to a route that the protocol forwards to the routing table manager. If confronted with multiple routes to the same destination, the routing table manager may use this value to decide which route to insert. Routes for all networks (0.0.0.0/0.0.0.0) should have the lowest preference and routes for the most specific networks (longest address and mask) should have the highest preference. |
| precedence | 0 (default) to any integer | Assigns a metric value to this policy (a policy with a higher value takes precedence over a policy with a lower value). This value determines the order of precedence for policies that match the same route. |

For example, the following command sets the state to disabled for RIP accept policy pol_1:

```
accept/pol_1/rip# state disabled
accept/pol_1/rip#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Accept**. | The RIP Accept Policies window opens. |
| 6. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Action**<br>• **Route Preference**<br>• **Route Precedence**<br>• **Networks**<br>• **From Gateway**<br>• **Received on Interface**<br>Click on **Help** or see the parameter descriptions beginning on page B-2. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Supplying Modification Values for a RIP Accept Policy

You can use the BCC or Site Manager to supply values that RIP uses to modify fields in a RIP update that matches the policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**modify**

A set prompt appears for the policy.

For example, the following command invokes a modification prompt for RIP accept policy pol_1:

```
accept/pol_1/rip# modify
modify/rip/accept/pol_1#
```

To specify a value, enter:

*<parameter> <value>*

*parameter value* is one of the parameter/value pairs shown in Table 6-2.

**Table 6-2. BCC Override Parameter for RIP Accept Policies**

| Parameter | Values | Function |
|---|---|---|
| mask | 0.0.0.0 or an IP mask | Specifies a mask that will override the interface's subnet mask in the presence of networks with variable-length subnet masks |

For example, the following command specifies an override mask of 255.0.0 for accept policy pol_1:

```
modify/rip/accept/pol_1# mask 255.0.0.0
modify/rip/accept/pol_1#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Accept**. | The RIP Accept Policies window opens. |
| 6. Set the **Apply Subnet Mask** parameter. Click on **Help** or see the parameter description on page B-9. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying Matching Criteria for a RIP Accept Policy

You can use the BCC or Site Manager to specify matching criteria for the policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**match**

A match prompt appears for the policy. Enter:

*<match_criterion> <ip_address>*

*match_criterion* is one of the BCC match objects listed in Table 6-3.

**Table 6-3. RIP Accept Policy Match Criteria**

| Object | Meaning |
|---|---|
| network* | Specifies the networks that match this policy. Each specification consists of a network IP address, a mask, and a flag to indicate whether the network address refers to a specific network or a range of networks. Enter a specific encoding of 0.0.0.0/0.0.0.0 to match the default route. Enter a range encoding of 0.0.0.0/0.0.0.0 to match any route. Use the default empty list to match any route. |
| rip-gateway* | Specifies the addresses of one or more routers that could send RIP updates to this router. This policy matches RIP advertisements from routers on this list. Use the default empty list to indicate that this policy applies to RIP updates from any router. |
| rip-interface* | Specifies the IP addresses of one or more interfaces on this router. This policy matches RIP updates received on interfaces that appear on this list. Use the default empty list to indicate that this policy applies to RIP updates received on any interface. |

* The BCC implements this matching criterion as an object. To specify a list, create multiple objects.

For example, the following command specifies RIP interface 2.2.3.3 as a match for RIP accept policy pol_1:

```
match/rip/accept/pol_1# rip-interface 2.2.3.3
rip-interface/2.2.3.3/rip/accept/pol_1#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Accept**. | The RIP Accept Policies window opens. |
| 6. Set the following parameters:<br>• **Networks**<br>• **From Gateway**<br>• **Received on Interface**<br>Click on **Help** or see the parameter descriptions on pages B-4 and B-8. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Defining a RIP Announce Policy

To define a new announce policy, you must do the following:

- Supply a name for the policy.
- Set the current state of the policy (enabled or disabled).
- Specify whether RIP announces or ignores an update that matches the policy.
- Rank the policy according to precedence and other criteria.

You can use the BCC or Site Manager to define a RIP announce policy.

### *Using the BCC*

To define a new announce policy, navigate to the RIP global prompt and enter:

**announce** *<policy_name>*

*policy_name* is a unique name for the announce policy.

A policy-specific prompt appears, indicating that the BCC has created the policy, using default values for all parameters.

For example, the following command creates a RIP announce policy named pol_1:

```
rip# announce pol_1
announce/pol_1/rip#
```

At the policy-specific prompt, enter:

*<parameter> <value>*

*parameter value* is one of the parameter/value pairs shown in Table 6-4.

**Table 6-4. BCC Definition Parameters for RIP Announce Policies**

| Parameter | Values | Function |
|---|---|---|
| state | Enable (default)<br>Disable | Enables or disables this policy |
| action | Ignore (default)<br>Propagate | Specifies whether or not to advertise a route that matches this policy |
| precedence | 0 (default) to any metric value | Specifies a metric value to compare this policy with other policies that a route may match. A policy with a higher metric takes precedence over a policy with a lower metric. In case of a tie, the protocol uses an internal index value assigned to the policy by IP software. (In general, the index value is indicated by the position of the policy in the Site Manager display -- the last policy in the display has the highest index value.) |

For example, the following command specifies a precedence value of 12 for RIP announce policy pol_1:

```
announce/pol_1/rip# precedence 12
announce/pol_1/rip#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Announce**. | The RIP Announce Policies window opens. |
| 6. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Action**<br>• **Route Precedence**<br>Click on **Help** or see the parameter descriptions beginning on page B-2. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Supplying Modification Values for a RIP Announce Policy

You can use the BCC or Site Manager to supply a value that RIP uses to modify field in a RIP update that matches the policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**modify**

A modification prompt appears for the policy.

For example, the following command invokes a set command for RIP announce policy pol_1:

```
announce/pol_1/rip# modify
modify/rip/announce/pol_1#
```

To specify an override value, enter:

*<parameter> <value>*

*parameter value* is one of the parameter/value pairs shown in Table 6-5.

**Table 6-5. BCC Override Parameter for RIP Announce Policies**

| Parameter | Values | Function |
|---|---|---|
| metric | 0 (the default) or an export metric | Specifies an optional RIP export metric to use when advertising a route that matches this policy |

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Announce**. | The RIP Announce Policies window opens. |
| 6. Set the **RIP Metric** parameter. Click on **Help** or see the parameter description in Appendix B. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying Matching Criteria for a RIP Announce Policy

You can use the BCC or Site Manager to specify matching criteria for the policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**match**

A match prompt for the policy appears.

For example, the following command invokes a match prompt for RIP announce policy pol_1:

```
announce/pol_1/rip# match
match/rip/announce/pol_1#
```

In response to the prompt, enter:

*<match_criterion>*

*match_criterion* is one of the parameter/value pairs shown in Table 6-6.

**Table 6-6. BCC Match Criteria for RIP Announce Policies**

| Parameter | Values/Default | Function |
|---|---|---|
| state | Enable (default)<br>Disable | Enables or disables this policy |
| external-source | Any (default)<br>Direct<br>Static<br>RIP<br>OSPF with type 2 Metric<br>EGP<br>BGP | Specifies one or more external route source identifiers. If you specify an external route source, a route from that source that meets the other criteria of this policy matches the policy. This parameter applies only to OSPF routes that use the new ASE type 2 metric. The protocol from which OSPF received the route is encoded in the ASE metric, along with the route's metric. To specify any external route source, use the default. |
| ospf-type | Any (default)<br>Type 1<br>Type 2<br>External<br>Internal | Specifies which types of OSPF routes match this policy, and applies only to OSPF-sourced routes and if OSPF is included as a route source |
| protocol-source | Any (default)<br>Direct<br>Static<br>RIP<br>OSPF<br>EGP<br>BGP | Specifies one or more route source identifiers. If you select a route source ID, a route from that source that meets the other criteria of this policy matches the policy. |
| bgp-as* | List of AS numbers | Specifies one or more autonomous system numbers. This policy applies to BGP advertisements received from BGP peers in an AS on this list, and applies only to BGP-sourced routes and if BGP is included as a route source. |
| bgp-next-hop* | List of IP addresses | Specifies one or more IP addresses. This policy applies to BGP advertisements whose Next Hop attribute matches an IP address on this list, and applies only to BGP-sourced routes and if BGP is included as a route source. |

*(continued)*

**Table 6-6. BCC Match Criteria for RIP Announce Policies** *(continued)*

| Parameter | Values/Default | Function |
|---|---|---|
| bgp-peer* | List of IP addresses | Specifies the IP address of one or more BGP peers. This policy applies to BGP advertisements authored by a router on this list, and applies only to BGP-sourced routes and if BGP is included as a route source. |
| egp-as* | List of AS numbers | Specifies one or more autonomous system numbers. This policy applies to EGP advertisements received from EGP peers in an AS on this list, and applies only to EGP-sourced routes and if EGP is included as a route source. |
| egp-gateway* | List of IP addresses | Specifies the IP address of one or more EGP gateways. This policy applies to EGP advertisements that use a gateway on this list as the next hop, and applies only to EGP-sourced routes and if EGP is included as a route source. |
| egp-peer* | List of IP addresses | Specifies the IP address of one or more EGP peers. This policy applies to EGP advertisements authored by a router on this list, and applies only to EGP source routes and if EGP is included as a route source. |
| inbound-interface* | List of IP addresses | Specifies the address of one or more interfaces on this router. This policy applies to RIP advertisements received on the interfaces on this list, and applies only to RIP-sourced routes and if RIP is included as a route source. |
| network* | List of IP addresses | Specifies which networks will match this policy. Each identifier consists of a network number, a mask, and a flag to indicate whether the ID refers to a specific network or a range of networks. Enter a specific encoding of 0.0.0.0/0.0.0.0 to match the default route. Enter a range encoding of 0.0.0.0/0.0.0.0 to match any route. Enter an empty list to match any route. |

*(continued)*

**Table 6-6. BCC Match Criteria for RIP Announce Policies** *(continued)*

| Parameter | Values/Default | Function |
|---|---|---|
| ospf-router-id* | List of IP addresses | Specifies the IDs of one or more OSPF routers. This policy applies to OSPF advertisements authored by a router on this list, and applies only to OSPF-sourced routes and if OSPF is included as a route source. |
| ospf-tag* | List of OSPF ASE tag values | Specifies tag values that could be present in an OSPF ASE advertisement. This policy applies to OSPF ASE advertisements that contain tag values in this list, and applies only to OSPF-sourced ASE routes and if OSPF is included as a route source. |
| outbound-interface* | List of IP addresses | Specifies a list of outbound RIP interfaces. If an interface appears on this list, the policy applies to RIP advertisements sent via that interface. |
| rip-gateway* | List of IP addresses | Specifies the addresses of one or more routers that could send RIP updates to this router. This policy applies to RIP advertisements from routers on this list, and applies only to RIP-sourced routes and if RIP is included as a route source. |

* The BCC implements this matching criterion as an object. To specify multiple items, create multiple objects.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **RIP**. | The RIP window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Announce**. | The RIP Announce Policies window opens. |
| 6. Set the following parameters:<br>• **Route Source**<br>• **External Route Source**<br>• **Advertise**<br>• **From RIP Gateway**<br>• **Received on RIP Interface**<br>• **RIP Metric**<br>• **Outbound Interfaces**<br>• **From OSPF Router ID**<br>• **Received OSPF Type**<br>• **Received OSPF Tag**<br>• **From EGP Peer**<br>• **From EGP AS**<br>• **Received EGP Gateway**<br>• **From BGP Peer**<br>• **From BGP AS**<br>• **Received BGP Next Hop**<br>Click on **Help** or see the parameter descriptions beginning on page B-30. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Chapter 7
# Customizing OSPF Services

You customize OSPF by setting OSPF parameters as described under the following topics:


| Topic | Page |
|---|---|
| OSPF Concepts and Terminology | 7-2 |
| Customizing OSPF Global Features | 7-8 |
| Customizing OSPF on an IP Interface | 7-25 |
| Defining an Area | 7-47 |
| Configuring an Area Border Router | 7-54 |
| Configuring OSPF Accept and Announce Policies | 7-58 |

# OSPF Concepts and Terminology

OSPF is a *link-state protocol*. A router running a link-state protocol periodically tests the status of the physical connection to each of its neighbor routers and sends this information to its other neighbors. A link-state protocol does not require each router to send its entire routing table to its neighbors. Instead, each OSPF router floods only link-state change information throughout the autonomous system (or area, if the AS is divided into areas). This process is referred to as the synchronization of the routers' topological databases.

With the link information, each router builds a *shortest-path tree* with itself as the root of the tree. It then can identify the shortest path from itself to each destination and build its routing table.

This section covers the following topics:


| Topic | Page |
|---|---|
| OSPF Addresses and Variable-Length Masks | 7-3 |
| OSPF Neighbors | 7-3 |
| Neighbor Adjacencies | 7-4 |
| Designated Routers | 7-4 |
| OSPF Areas | 7-5 |
| OSPF Router Types | 7-6 |
| AS External Routes | 7-6 |
| OSPF Implementation Notes | 7-7 |

## OSPF Addresses and Variable-Length Masks

A destination in as OSPF route advertisement is expressed as an IP address and a variable-length mask. Taken together, the address and the mask indicate the range of destinations to which the advertisement applies.

The ability to specify a range of networks allows OSPF to send one summary advertisement that represents multiple destinations. For example, a summary advertisement for the destination 128.185.0.0 with a mask of 0xffff0000 describes a single route to destinations 128.185.0.0 to 128.185.255.255.

## OSPF Neighbors

OSPF *neighbors* are any two routers that have an interface to the same network. In each OSPF network, routers use the Hello protocol to discover their neighbors and maintain neighbor relationships. On a broadcast or point-to-point network, the Hello protocol dynamically discovers neighbors; however, on a nonbroadcast multiaccess network, you must manually configure neighbors.

The Hello protocol ensures that communication between neighbors is bidirectional. Periodically, OSPF routers send out hello packets over all interfaces. Included in these hello packets is the following information:

- The router's priority
- The router's Hello Timer and Dead Timer values
- A list of routers that have sent this router hello packets on this interface
- The router's choice for designated router and backup designated router

Bidirectional communication is determined when one router sees itself listed in the neighbor's hello packet.

## Neighbor Adjacencies

Neighbors may form an *adjacency* for the purpose of exchanging routing information. When two routers form an adjacency, they go through a process called *database exchange* to synchronize their topological databases. When their databases are synchronized, the routers are said to be fully adjacent. From this point on, only routing change information is passed between the adjacencies, thus conserving bandwidth.

All routers connected by a point-to-point network or a virtual link will always form an adjacency. Also, every router on a multiaccess network forms an adjacency relationship with the designated router and the backup designated router.

## Designated Routers

To further reduce the amount of routing traffic, the Hello protocol elects a *designated router* and a *backup designated router* on each multiaccess network. Instead of neighboring routers forming adjacencies and swapping link-state information with each other (which on a large network can mean a lot of routing protocol traffic), all routers on the network form adjacencies with the designated router and the backup designated router only and send link state information to them. The designated router then redistributes the information from each router to every other router.

The Hello protocol always elects a backup designated router along with the designated router. This router takes over all of the designated router's functions should the designated router fail.

## OSPF Areas

OSPF routers reduce and restrict the amount of internal and external routing information that is flooded through the AS by dividing the AS into *areas*. Figure 7-1 shows an OSPF autonomous system divided into three areas and a required central area called a *backbone* that is used to distribute routing information among areas.

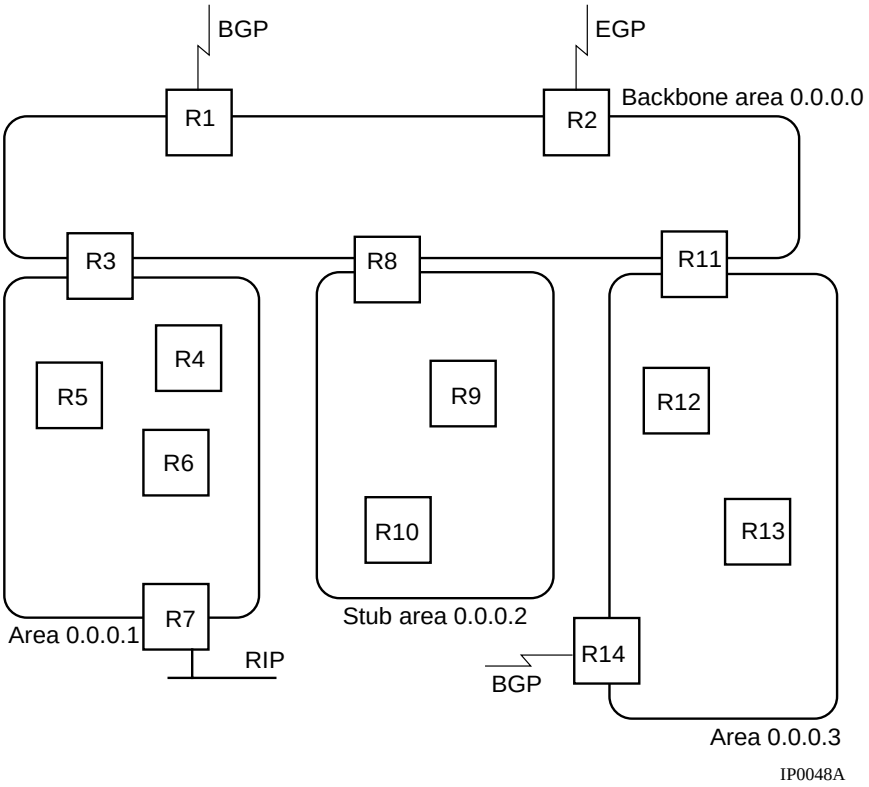


**Figure 7-1. OSPF Areas**

Each area has a unique ID number. (ID 0.0.0.0 is always reserved for the OSPF backbone.) The AS in Figure 7-1 has three areas (0.0.0.1, 0.0.0.2, and 0.0.0.3) and a backbone (0.0.0.0).

For information about associating an OSPF interface with an area ID, see “Configuring an Area ID” on page 7-29.

## OSPF Router Types

OSPF defines the following router types:

*Internal router.* A router with interfaces to networks in one area only. Internal routers flood each area with complete routing information about changes that occur within the area. In area 0.0.0.1, for example, R4, R5, and R6 are internal routers.

*Border router.* A router with an interface to the backbone network and interfaces to one or more additional areas. Each border router connects one or more areas to the backbone. In Figure 7-1, R3, R8, and R11 are border routers. Using the backbone, border routers ensure that AS external routes (ASEs) and summaries of routing information for all areas are distributed throughout the AS.

*Boundary router.* A router configured to learn AS external routes and to inject this information into an OSPF AS.

## AS External Routes

OSPF considers the following routes to be *AS external (ASE)* routes:

- A route to a destination outside the AS
- A static route
- A default route
- A route derived by RIP
- A directly connected network not running OSPF

In Figure 7-1, for example, routers R1 and R2 are boundary routers that use BGP and EGP to connect the backbone to external ASs. R7 in area 0.0.0.1 is also a boundary router, connecting the area to an external RIP network. R14 in area 0.0.0.3 connects the area to an external AS via BGP.

## OSPF Implementation Notes

This section provides some suggestions to help you configure your OSPF network. The Bay Networks OSPF implementation does not restrict you to these suggestions, but we provide them as guidelines.

- Keep the same password throughout an area, or even throughout the entire OSPF AS, if possible.
- Use the default timers, unless you are running 9.6 KB synchronous lines. In this case, double the default timers on both ends of the link.
- Use address ranges if your network is a subnetted network.
- Keep all subnets within one area. If you cross areas, you cannot configure summaries.
- Make sure the AS Boundary Router function is enabled if the router has any non-OSPF interfaces and if you want that information propagated.
- You must configure virtual links for each area border router that does not reside within or directly interface to the backbone. Every area border router must have a configured path to the backbone.
- Rather than just a hop count, OSPF considers the cost of a path when choosing the best path. Each interface, however, is assigned the default cost 1 for the path to which it interfaces. If you have a preferred path, you must edit the Metric Cost parameter for your interfaces. You will need to assign a higher metric cost for those paths that are *not* preferred paths.
- If you have any devices in your network running OSPF, and are now adding a Bay Networks router, you must make sure that the router's timer values coincide with the timers in your other devices. Determine the timer values of the other devices, and change the router's timer values to match them.
- If you change the topology (for example, if you add an area, combine two areas, move routers, and so on), you must reconfigure the appropriate OSPF elements (OSPF area ranges/interfaces/neighbors/virtual links, and so on).

# Customizing OSPF Global Features

OSPF global features affect the way OSPF runs on the router. They apply to all OSPF interfaces.

You customize OSPF global features by setting parameters as described under the following topics:


| Topic | Page |
|---|---|
| Navigating the BCC to the OSPF Global Prompt | 7-9 |
| Opening the Site Manager Window for OSPF Global Parameters | 7-9 |
| Enabling and Disabling OSPF on the Router | 7-10 |
| Supplying an OSPF ID | 7-11 |
| Configuring the Soloist and Backup Soloist on a Slot | 7-12 |
| Enabling the Boundary Function | 7-14 |
| Configuring the Metric Type for an ASE Advertisement | 7-15 |
| Choosing a Tag Generation Method for an ASE Advertisement | 7-18 |
| Setting the Holddown Timer | 7-21 |
| Configuring Message Logging | 7-22 |

## Navigating the BCC to the OSPF Global Prompt

Beginning at the global IP prompt, enter:

**ospf**

To display OSPF global parameters and their current values, enter:

**info**

For example:

```
ip# ospf
ospf# info
  on ip
  state enabled
  router-id 2.2.2.2
  slot-mask all-slots
  as-boundary-router false
  holddown 1
  ase-metric-support disabled
  backup-lsdb disabled
  log-mask 287
  backup-log-mask 0
  as-default-tag default
ospf#
```

## Opening the Site Manager Window for OSPF Global Parameters

Use the following Site Manager procedure to open the OSPF global window. The window displays all OSPF global parameters and their current values.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Global**. | The Edit OSPF Global Parameters window opens. |

## Enabling and Disabling OSPF on the Router

When you start OSPF on the router, OSPF is automatically enabled.

You can use the BCC or Site Manager to disable and reenable OSPF on the router.

### *Using the BCC*

Navigate to the global OSPF prompt and enter:

**state** *<state>*

*state* is one of the following:

**enabled** (default)
**disabled**

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Global**. | The Edit OSPF Global Parameters window opens. |
| 5. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-70. | The value you chose appears in the Enable field. |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Supplying an OSPF ID

Each router configured with OSPF has an OSPF ID. This IP address uniquely identifies this router in the OSPF domain.

By convention, and to ensure uniqueness, the router ID should be one of the router's IP interface addresses.

The router ID determines the designated router on a broadcast link if the priority values of the routers being considered are equal. The higher the router ID, the greater its priority.

If both OSPF and BGP are running on the router, the OSPF router ID must be identical to the BGP identifier. In addition, the OSPF router ID must match one of the IP addresses configured on the router.

By default, OSPF uses the IP address of the first OSPF circuit configured on this router. You can use the BCC or Site Manager to specify an IP address.

### *Using the BCC*

Navigate to the global OSPF prompt and enter:

**router-id** <*ip_address*>

*ip_address* is a valid IP address in dotted-decimal notation.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Global**. | The Edit OSPF Global Parameters window opens. |
| 5. Set the **Router ID** parameter. Click on **Help** or see the parameter description on page A-70. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring the Soloist and Backup Soloist on a Slot

The OSPF protocol is implemented as a *soloist* -- that is, as a single process running on a single slot of a router. When you add an OSPF interface to a circuit, the router enables OSPF on a slot. If the slot on which the OSPF soloist is running goes down, the router tries to run OSPF on another slot.

Each time the OSPF soloist is restarted, all of the routing information is lost and must be relearned from the network. The *OSPF backup soloist* provides a method of preserving information learned from the network in the event of an OSPF crash or slot removal, avoiding the time-consuming and resource-intensive process of relearning routing information. In the event of a crash or slot removal, transition between the OSPF primary and backup soloists occurs without relearning routing information from the network.

By default, the router uses any available slot for the OSPF soloist. You can use the BCC or Site Manager to specify a slot.

By default, OSPF does not maintain a copy of the link state database (LSDB) for the backup soloist. You can use the BCC or Site Manager to enable this feature.

### *Using the BCC*

To specify a slot for the OSPF soloist, navigate to the global OSPF prompt and enter:

**slot-mask** *<slot>*

*slot* is **all-slots** (the default) or an integer from 1 to 14 to indicate a slot.

To maintain a copy of the LSDB for the backup soloist, navigate to the global OSPF prompt and enter:

**backup-lsdb enable**

For example, the following command sequence specifies slot 12 for the OSPF soloist and causes OSPF to maintain a separate copy of the LSDB for the backup soloist:

```
ospf# slot-mask 12
ospf# backup-lsdb enable
ospf#
```

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Global**. | The Edit OSPF Global Parameters window opens. |
| 5. Set the following parameters:<br>• **OSPF Slot**<br>• **Backup Enable**<br>Click on **Help** or see the parameter descriptions beginning on page A-71. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Enabling the Boundary Function

An OSPF boundary router does the following:

1. Receives information about routes outside the OSPF AS (using BGP, RIP, or another routing protocol)
2. Formats this information in AS external (ASE) advertisements
3. Propagates the ASEs into the OSPF domain (using OSPF)

By default, the boundary function is disabled on the router. You can use the BCC or Site Manager to configure the router as an OSPF boundary router.

### *Using the BCC*

Navigate to the global OSPF prompt and enter:

**as-boundary-router** *<state>*

*state* is one of the following:

**true**
**false** (default)

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Global**. | The Edit OSPF Global Parameters window opens. |
| 5. Set the **AS Boundary Router** parameter. Click on **Help** or see the parameter description on page A-70. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring the Metric Type for an ASE Advertisement

**Note:** This parameter applies to boundary routers only.

Each ASE that a boundary router injects into the AS includes a type 1 or type 2 metric. The type 1 metric is equivalent to the metric of the non-OSPF route. The type 2 metric is either the metric of the non-OSPF route or the weight value calculated for that route.

Figure 7-2, for example, shows three routers in an OSPF domain. Router A and router B are both configured to generate ASE routes using the route weight as the type 2 metric. Router A and router B both learn a route to destination X. The following steps occur:

1. Boundary router A learns a route to destination X via EGP.
2. Boundary router A advertises the route to the internal router as an OSPF ASE route. The type 2 metric in the advertisement contains the route weight value calculated for the EGP route to destination X.
3. Boundary router B learns a route to destination X via BGP.
4. Boundary router B advertises the route to the internal router as an OSPF ASE route. The type 2 metric in the advertisement contains the route weight value calculated for a BGP route.
5. To determine the preferable route, the internal router compares the type 2 metrics -- the EGP route weight and the BGP route weight.
6. The internal router chooses the BGP route -- the route with the lower weight.

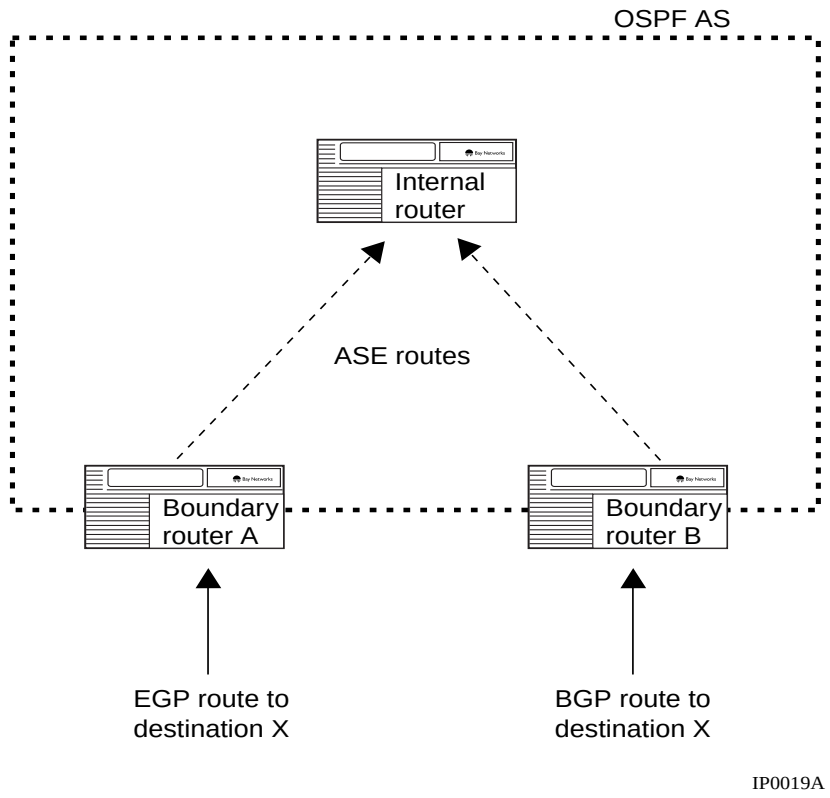


**Figure 7-2. OSPF ASE Routes**

By default, an OSPF boundary router generates a type 2 metric for BGP, EGP, or RIP routes. For routes from all other sources, the boundary router generates a type 1 metric.

**Note:** The route weight value will appear to be greater than the route's original metric. For this reason, all routers advertising a particular network must use the same metric type -- type 1 or type 2. If not, the router that receives the advertisements may choose the wrong route.

Using the BCC or Site Manager, you can configure a boundary router to use the route weight as the OSPF metric.

### *Using the BCC*

Navigate to the global IP prompt and enter:

**ase-metric-support** *<state>*

*state* is one of the following:

**enabled**
**disabled** (default)

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Global**. | The Edit OSPF Global Parameters window opens. |
| 5. Set the **ASE Metric Support** parameter. Click on **Help** or see the parameter description on page A-71. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Choosing a Tag Generation Method for an ASE Advertisement

**Note:** This parameter applies to boundary routers only.

An OSPF AS external route advertisement includes an external route tag field. This field allows boundary routers in an AS to exchange information about external routes. (The specific nature of this information is outside the scope of OSPF.)

By default, Bay Networks boundary routers that generate ASEs set the external route tag field to 0. For a boundary router running OSPF and BGP, you can configure OSPF to set the external route tag field with a value in accordance with RFC 1403, *OSPF/BGP Interaction*.

In Figure 7-3, for example, boundary router R14 running OSPF and BGP learns external routes via BGP:

1. Router R14 generates an ASE describing the route. OSPF fills in the external route tag with BGP-specific information according to RFC 1403.
2. Router R14 injects the ASE into the AS, and OSPF routers flood the ASE throughout the AS.
3. Router R1, which runs OSPF and BGP, receives the ASE. R1 generates a BGP update, using the contents of the external route tag to set the Origin and AS Path attributes in the update.

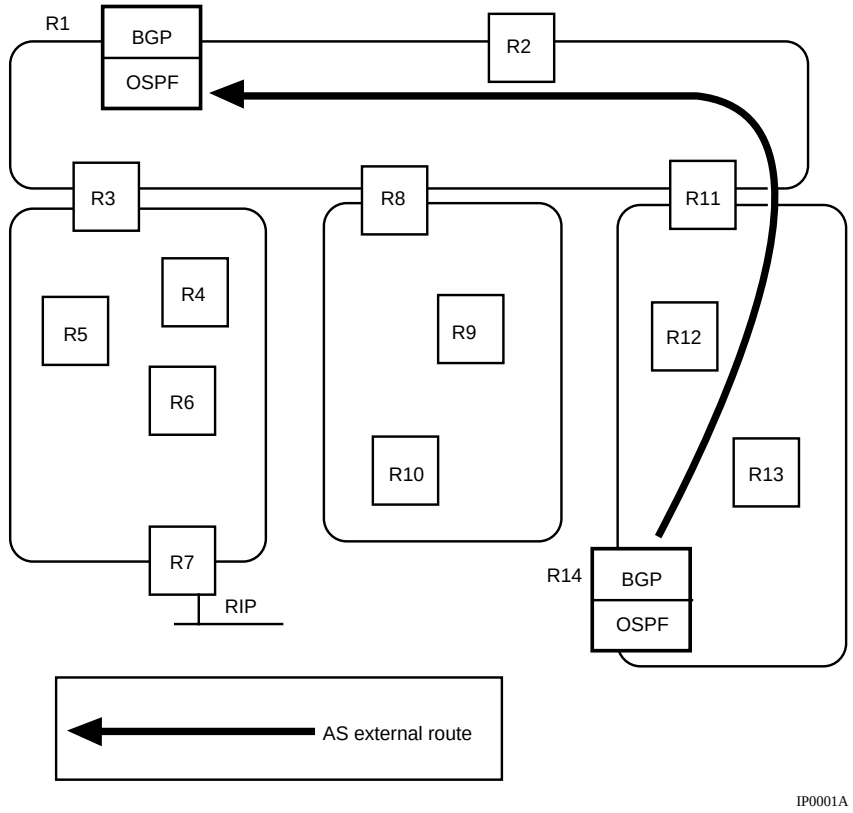


**Figure 7-3. AS External Route Tag**

You can use the BCC or Site Manager to choose the tag generation method.

### *Using the BCC*

Navigate the global IP prompt and enter:

**as-default-tag** *<method>*

*method* is one of the following:

**zero** (default)
**auto**
**wf**

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Global**. | The Edit OSPF Global Parameters window opens. |
| 5. Set the **Tag Generation Method** parameter. Click on **Help** or see the parameter description on page A-73. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Setting the Holddown Timer

The holddown timer controls how often OSPF calculates a route. Its purpose is to free up the CPU. Note that a value of 0 means there is no holddown time.

By default, the holddown timer is set at 1 second. You can use the BCC or Site Manager to specify a different value.

### *Using the BCC*

Navigate to the global OSPF prompt and enter:

**holddown** *<value>*

*value* is 0 (no holddown time) or the holddown time in seconds.

For example, the following command specifies 5 seconds as the OSPF holddown time:

```
ospf# holddown 5
ospf#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Global**. | The Edit OSPF Global Parameters window opens. |
| 5. Set the **Hold Down Timer** parameter. Click on **Help** or see the parameter description on page A-71. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring Message Logging

OSPF maintains a primary and backup log for OSPF messages.

By default, OSPF logs the following messages in the primary log:

- Trace
- Info
- Debug
- INTF State
- NBR State
- Bad LS

By default, OSPF logs no messages in the backup log.

You can use the BCC or Site Manager to specify the messages that OSPF writes to the primary and backup log.

OSPF can log any or all of the messages shown in Table 7-1:

**Table 7-1. OSPF Log Messages**

| Message | Example |
|---|---|
| Trace | Designated Router changed on network: x.x.x.x x.x.x.x -> x.x.x.x |
| Info | OSPF enabled |
| OSPF debug | OSPF couldn't get a buffer, dying |
| INTF state | Interface x.x.x.x up on circuit x |
| NBR state | T2: Neighbor x.x.x.x Event: x State change: x->x |
| LSA self-origin | T4: Originating new LSA - type x LSID x.x.x.x router x.x.x.x |
| LSA receipt | T5: Received new LSA - type x LSID x.x.x.x router x.x.x.x neighbor x.x.x.x |
| Route change | T6: Routing Table changed - type x destination x.x.x.x old x.x.x.x new x.x.x.x |
| Bad LS | R4: Ack received for non-existent LSA: type x LSID x.x.x.x neighbor x.x.x.x |

*(continued)*

**Table 7-1. OSPF Log Messages** *(continued)*

| | |
|---|---|
| Less recent LSA | C3: Packet Rejected: LS UPDATE: LESS RECENT RX (x) src x.x.x.x type x ls_id: x.x.x.x adv_rtr: x.x.x.x ls_seq: x ls_age: x db_seq: x db_age: x elapse: x freeme:x ackcnt:x nbr_retrans:x nbrEcnt:x Fcnt:x |
| More recent LSA | R3: Received more recent self-originated LSA: type x LSID x.x.x.x router x.x.x.x neighbor x.x.x.x |
| Max age LSA | N3: LSA of MaxAge flushed: type x LSID x.x.x.x router x.x.x.x |

### *Using the BCC*

To specify the messages that OSPF writes to the primary log, navigate to the global OSPF prompt and enter:

**log-mask** *<mask>*

To specify the messages that OSPF writes to the backup log, navigate to the global OSPF prompt and enter:

**backup-log-mask** *<mask>*

*mask* is a bit sequence indicating the messages you want to log.

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Global**. | The Edit OSPF Global Parameters window opens. |
| 5. Set the following parameters:<br>• **Primary Log Mask**<br>• **Backup Log Mask**<br>Click on **Help** or see the parameter descriptions beginning on page A-72. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring External Route Preference

By default, when OSPF receives multiple AS-external LSAs for the same destination, OSPF applies the preference rules specified by RFC 1583.

You can use Site Manager to configure OSPF to apply the preference rules specified by RFC 1583. These rules are designed to prevent routing loops when AS-external LSAs for the same destination originate from different areas.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Global**. | The Edit OSPF Global Parameters window opens. |
| 5. Set the **Set the RFC 1583 Compatibility** parameter. Click on **Help** or see the parameter description on page A-75. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

# Customizing OSPF on an IP Interface

When you add OSPF to an IP interface, OSPF is configured on the interface with default values for all interface parameters. You customize OSPF on the interface by modifying values as described under the following topics:


| Topic | Page |
|---|---|
| Navigating the BCC to an OSPF Interface Prompt | 7-26 |
| Opening the Site Manager Window for OSPF Interfaces | 7-27 |
| Enabling and Disabling OSPF | 7-28 |
| Configuring an Area ID | 7-29 |
| Specifying the Interface Type | 7-30 |
| Using Point-to-Multipoint Interfaces in a Star Topology | 7-32 |
| Specifying Router Priority for a Multiaccess Network | 7-33 |
| Estimating the Transit Delay | 7-35 |
| Setting the Retransmit Interval | 7-36 |
| Setting the Hello Interval | 7-37 |
| Setting the Dead Interval | 7-39 |
| Setting the Poll Interval for NBMA Neighbors | 7-41 |
| Specifying the Metric Cost | 7-42 |
| Specifying the MTU Size | 7-44 |
| Configuring a Neighbor on an NBMA Interface | 7-46 |

## Navigating the BCC to an OSPF Interface Prompt

Beginning at the prompt for an IP interface to which you have added OSPF, enter:

**ospf**

An OSPF interface-specific prompt appears.

To display OSPF parameters for this interface and their current (default) values, enter:

**info**

For example, the following command sequence invokes the OSPF prompt for IP interface 2.2.2.2 and displays OSPF interface parameters and values:

```
ip/2.2.2.2/255.0.0.0# ospf
ospf/2.2.2.2# info
  on ip/2.2.2.2/255.0.0.0
  state enabled
  area 0.0.0.1
  authentication {}
  type broadcast
  priority 1
  transit-delay 1
  retransmission-interval 5
  hello-interval 10
  dead-interval 40
  poll-interval 120
  metric 1
  mtu 1
ospf/2.2.2.2#
```

## Opening the Site Manager Window for OSPF Interfaces

Use the following Site Manager procedure to open the OSPF Interfaces window and choose the OSPF interface whose parameter values you want to display:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want to enable. | The parameter values for that interface appear in the OSPF Interfaces window. |

## Enabling and Disabling OSPF

When you add OSPF to an IP interface, OSPF is automatically enabled on that interface. The interface will be advertised as an internal route. In addition, the interface can be used to form a neighbor relationship.

You can use the BCC or Site Manager to disable and reenable OSPF on an interface.

### *Using the BCC*

Navigate to an OSPF interface-specific prompt and enter:

**state** <*state*>

*state* is one of the following:

**enabled** (default)
**disabled**

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want to enable. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-76. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Configuring an Area ID

In an AS that contains multiple areas, each OSPF interface is configured with the ID of the area to which it is connected.

You supply an area ID when you add OSPF to the interface. You can use the BCC or Site Manager to assign a different area ID to the interface.

### *Using the BCC*

Navigate to the interface-specific OSPF prompt and enter:

**area** <*area_id*>

*area_id* is an area identifier in dotted-decimal format.

For example, the following command assigns area ID 0.0.0.2 to interface 2.2.2.2. (This means that interface 2.2.2.2 connects the router to a network in OSPF area 0.0.0.2.)

```
ospf/2.2.2.2# area 0.0.0.2
ospf/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **Area ID** parameter. Click on **Help** or see the parameter description on page A-76. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying the Interface Type

OSPF supports the following types of interface:

- *Broadcast.* An interface connected to a broadcast network that supports multiple routers. OSPF can address a single physical message to all attached routers. Examples of such a network are Ethernet, FDDI, and token ring.
- *Nonbroadcast multiaccess* (NBMA). An interface to an NBMA network that supports multiple routers. However, OSPF cannot address a single physical message to all routers. Examples of such a network are frame relay and X.25.
- *Point-to-point.* An interface to a point-to-point network that joins a single pair of OSPF routers. An example of such a network is a network of synchronous lines.
- *Point-to-multipoint.* An interface to a point-to-multipoint network that supports multiple routers in a partial mesh configuration. Bay Networks supports the standard OSPF point-to-multipoint interface and also provides a proprietary point-to-multipoint solution for routers running OSPF in star frame relay topologies.
- *Passive*. A passive interface only receives advertisements. OSPF cannot use it to form neighbor relationships, accept hello messages, or send advertisements. On other interfaces, OSPF advertise the network attached to a passive interface as a stub network.

**Note:** If the interface is connected to an NBMA network, you need to configure neighbors manually.

By default, OSPF assumes that the interface is attached to a broadcast network.You can use the BCC or Site Manager to specify another network type.

### *Using the BCC*

Navigate to an interface-specific OSPF prompt and enter:

**type** <*interface_type*>

*interface_type* is one of the interface types described in Table 7-2.

**Table 7-2. OSPF Interface Types**

| | |
|---|---|
| Broadcast | Default. Choose broadcast if this network is a broadcast LAN, such as Ethernet. |
| NBMA | Choose NBMA (nonbroadcast multiaccess) if the network is a nonbroadcast network, such as X.25. |
| Pointopoint | Choose point-to-point for a synchronous, point-to-point interface. |
| IETF | Choose IETF if the network is a point-to-multipoint network. |
| PMP | Choose PMP (point-to-multipoint) if you want to use the Bay Networks proprietary solution for frame relay point-to-multipoint networks. |
| Passive | Choose passive to configure an interface that OSPF cannot use to form neighbor relationships. OSPF cannot accept hello messages or send advertisements on the passive interface. |

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **Type** parameter. Click on **Help** or see the parameter description on page A-77. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Using Point-to-Multipoint Interfaces in a Star Topology

OSPF point-to-multipoint interfaces provide an efficient means to connect routers in a star topology. The routers are configured as follows:

- The hub of the star topology -- the BCN® router in Figure 7-4 -- is configured with a point-to-multipoint interface to the PVC and is set to be the OSPF designated router in the network. The Router Priority parameter is set to a value greater than 0.
- Each spoke of the star -- the AN® routers in Figure 7-4 -- is configured with a point-to-multipoint interface to the PVC and is made ineligible to become the designated router. The Router Priority parameter on each AN is set to 0.

When the spokes of the topology (the AN routers) are computing routes through the other spokes, the next hop is forced to be the hub (the BCN router). The hub can then forward the packet to the correct spoke.

Running OSPF with point-to-multipoint network interfaces addresses two problems: how to minimize the number of subnets and the number of interfaces required to support communications within the star topology. With point-to-multipoint interfaces, each star topology requires only one subnet, rather than one subnet for each PVC. Also, the hub needs to support only one interface for each star rather than one interface for each PVC, reducing the demand for resources on the router.

The Bay Networks proprietary point-to-multipoint solution is intended for routers running OSPF in star frame relay topologies. Figure 7-4, for example, shows a point-to-multipoint topology in which four AN routers are connected by frame relay links to a BCN router. The AN routers are the spokes of the topology, and the BCN router is the hub. All of the routers are running OSPF. The BCN router is connected to the frame relay network over a PVC in group mode. The AN routers are connected over PVCs in direct or group mode. For details on frame relay, see *Configuring Frame Relay Services.*

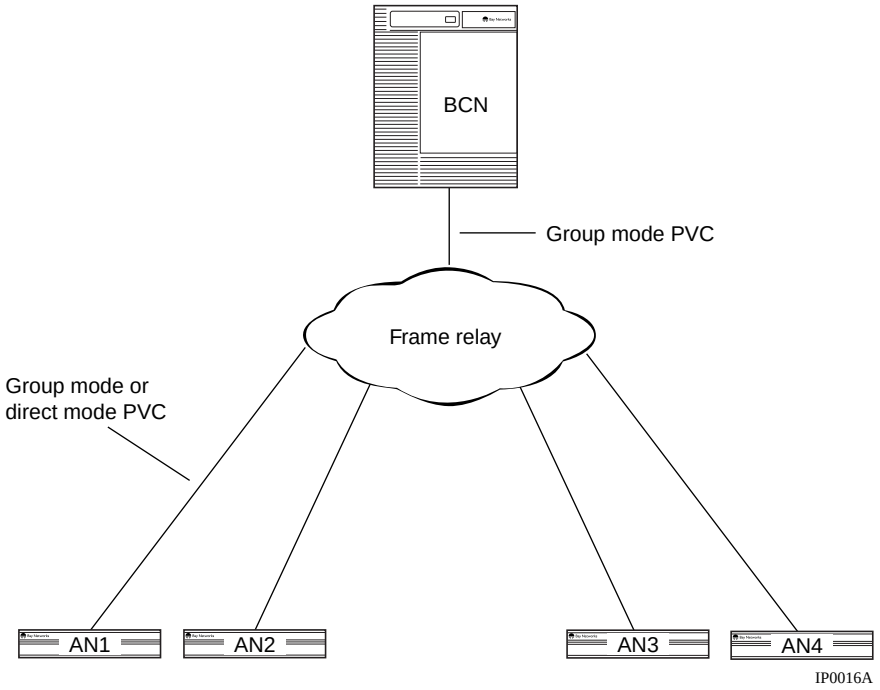


**Figure 7-4. Point-to-Multipoint Topology**

## Specifying Router Priority for a Multiaccess Network

The router priority value is used in multiaccess networks (broadcast, NBMA, or point-to-multipoint) to elect the designated router.

A router with a priority of 0 is not eligible to become the designated router on this particular network.

In the case of equal router priority values, the router ID will determine which router will become the designated router. However, if there already is a designated router on the network when you start this router, it will remain the designated router no matter what your priority or router ID.

By default, each OSPF interface has a router priority of 1.

You can use the BCC or Site Manager to do the following:

- Specify a priority value for the interface.
- Make the router ineligible to be a designated router on this interface.

### *Using the BCC*

Navigate to an interface-specific OSPF prompt and enter:

**priority** *<priority>*

*priority* is 0 (the router is ineligible to become a designated router) or an integer indicating the priority level.

For example, the following command assigns a priority of 2 to interface 2.2.2.2:

```
ospf/2.2.2.2# priority 2
ospf/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **Rtr Priority** parameter. Click on **Help** or see the parameter description on page A-77. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Estimating the Transit Delay

By default, OSPF assigns a transmission delay of 1 second to an OSPF interface.

You can use the BCC or Site Manager to supply a different transit delay estimate.

### *Using the BCC*

Navigate to an interface-specific OSPF prompt and enter:

**transit-delay** <*delay*>

*delay* is the transit delay in seconds.

For example, the following command assigns a transit delay value of 3 seconds to interface 2.2.2.2:

```
ospf/2.2.2.2# transit-delay 3
ospf/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **Transit Delay** parameter. Click on **Help** or see the parameter description on page A-78. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Setting the Retransmit Interval

The retransmit interval is the number of seconds between link-state advertisement retransmissions for adjacencies belonging to this interface.

Each type of network has an optimum retransmit interval. If the interface is connected to a broadcast network, Bay Networks suggests you use the default setting of 5 seconds. Table 7-3 lists the suggested settings for network types supported by OSPF.

**Table 7-3. Retransmit Interval Settings**

| Network Type | Suggested Retransmit Interval (seconds) |
|---|---|
| Broadcast | 5 (default) |
| Point-to-point | 10 |
| NBMA | 10 |
| Point-to-multipoint | 10 |

You can use the BCC or Site Manager to specify a retransmit interval.

### *Using the BCC*

Navigate to an interface-specific OSPF prompt and enter:

**retransmission-interval** *<interval>*

*interval* is the number of seconds between retransmissions.

For example, the following command specifies an OSPF retransmission interval of 10 seconds for IP interface 2.2.2.2:

```
ospf/2.2.2.2# retransmission-interval 10
ospf/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **Retransmit Interval** parameter. Click on **Help** or see the parameter description on page A-78. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Setting the Hello Interval

The hello interval specifies how often the router sends hello messages on the interface. By default, OSPF transmits a hello message every 10 seconds.

Each type of network has an optimum hello interval. If the interface is connected to a broadcast network, Bay Networks suggests you use the default setting -- 10 seconds. Table 7-4 lists the suggested settings for network types supported by OSPF.

**Table 7-4. Hello Interval Settings**

| Network Type | Suggested Hello Interval (seconds) |
|---|---|
| Broadcast | 10 (default) |
| Point-to-point | 15 |
| NBMA | 20 |
| Point-to-multipoint | 15 |

**Note:** This value must be the same for all routers attached to the same network.

You can use the BCC or Site Manager to specify a hello interval.

### *Using the BCC*

Navigate to an interface-specific OSPF prompt and enter:

**hello-interval** <*interval*>

*interval* is the number of seconds between hello messages.

For example, the following command causes OSPF to transmit a hello message every 20 seconds on IP interface 2.2.2.2:

```
ospf/2.2.2.2# hello-interval 20
ospf/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **Hello Interval** parameter. Click on **Help** or see the parameter description on page A-79. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Setting the Dead Interval

The dead interval is the number of seconds that OSPF waits to receive a hello packet from a neighbor before considering the neighbor to be down. The dead interval value should be some multiple of the hello interval value.

Each type of network has an optimum dead interval. If the interface is connected to a broadcast network, Bay Networks suggests you use the default setting -- 40 seconds. Table 7-5 lists the suggested settings for other network types supported by OSPF.

**Table 7-5. Dead Interval Settings**

| Network Type | Suggested Dead Interval (seconds) |
|---|---|
| Broadcast | 40 (default) |
| Point-to-point | 60 |
| NBMA | 80 |
| Point-to-multipoint | 60 |

**Note:** This value must be the same for all routers attached to the same network.

You can use the BCC or Site Manager to specify a dead interval.

### *Using the BCC*

Navigate to an interface-specific OSPF prompt and enter:

**dead-interval** <*interval*>

*interval* is the dead interval expressed in seconds.

For example, the following command causes OSPF to wait 60 seconds on IP interface 2.2.2.2 for a hello message before declaring the neighbor down:

```
ospf/2.2.2.2# dead-interval 60
ospf/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **Dead Interval** parameter. Click on **Help** or see the parameter description on page A-79. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Setting the Poll Interval for NBMA Neighbors

The poll interval is the largest number of seconds allowed between hello packets sent to an inactive nonbroadcast multiaccess (NBMA) neighbor.

By default, each OSPF interface has a poll interval of 120 seconds. You can use the BCC or Site Manager to specify a poll interval.

### *Using the BCC*

Navigate to an interface-specific OSPF prompt and enter:

**poll-interval** <*interval*>

*interval* is the poll interval expressed in seconds.

For example, the following command sets the poll interval to 90 seconds on IP interface 2.2.2.2:

```
ospf/2.2.2.2# poll-interval 90
ospf/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **Poll Interval** parameter. Click on **Help** or see the parameter description on page A-80. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying the Metric Cost

For OSPF, the best path is the one that offers the least-cost metric.

You must configure cost metrics if you want to specify a preferred path. Allow the preferred path to retain the cost metric value of 1, and then assign higher-cost metric values to the less-preferred paths.

Figure 7-5 shows the benefit of using configurable cost metrics. Assigning the 56 Kb line a cost metric value of 10 forces OSPF to choose the faster T1 line path as the best path, despite the extra hop, when transmitting a packet from host A to host B.

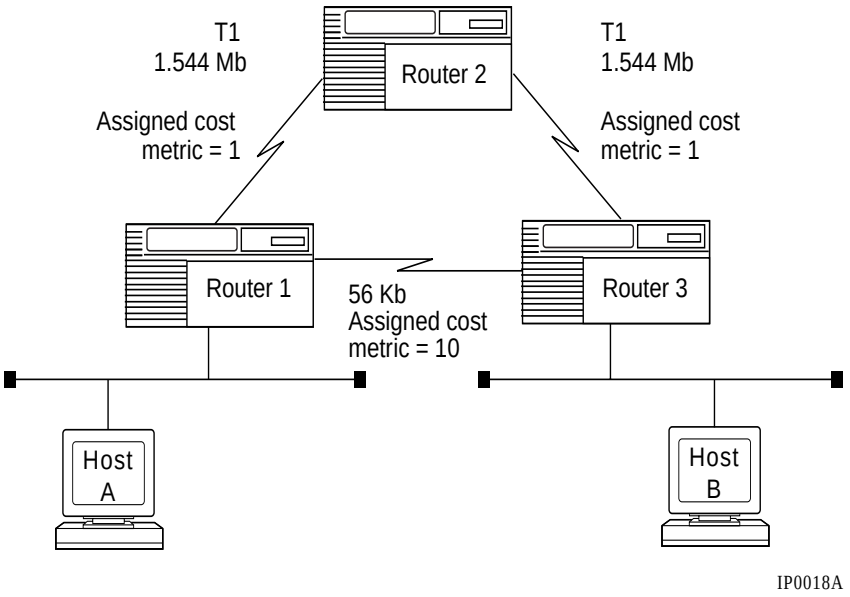


**Figure 7-5. Example of Using Configurable Cost Metrics**

There is an optimum cost for each type of network. Table 7-6 lists the suggested values for the metric cost parameter.

**Table 7-6. Cost Settings**

| Network Type or Bit Rate | Suggested Metric Cost |
|---|---|
| > = 100 Mb/s | 1 (default) |
| Ethernet/802.3 | 10 |
| E1 | 48 |
| T1 | 65 |
| 64 Kb/s | 1562 |
| 56 Kb/s | 1785 |
| 19.2 Kb/s | 5208 |
| 9.6 Kb/s | 10416 |

By default, each OSPF interface has a cost of 1. You can use the BCC or Site Manager to specify a metric cost for the interface.

### *Using the BCC*

Navigate to an interface-specific OSPF prompt and enter:

**metric** <*metric*>

*metric* is the cost of the interface expressed as an integer.

For example, the following command assigns a metric value of 10 to IP interface 2.2.2.2:

```
ospf/2.2.2.2# metric 10
ospf/2.2.2.2#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **Metric Cost** parameter. Click on **Help** or see the parameter description on page A-80. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying the MTU Size

OSPF recognizes a maximum transmission unit (MTU) size for updates transmitted on an interface. By default, when you configure OSPF on an interface, OSPF uses the MTU size specified for the type of network to which the interface is connected.

**Note:** When running OSPF over a synchronous/PPP link, set the MTU size to a value less than the synchronous MTU size (1200). This setting allows all OSPF routes to be learned over the link.

Using Site Manager, you can configure OSPF to do the following:

- Send packets no larger than the IP MTU size for Ethernet (1500).
- Use the MTU size you specify. The number you enter must be less than the IP MTU size for that physical interface.

### *Using the BCC*

Navigate to an interface-specific OSPF prompt and enter:

**mtu** <*size*>

*size* is the MTU size in bytes.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface you want. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Set the **MTU Size** parameter. Click on **Help** or see the parameter description on page A-81. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Configuring a Neighbor on an NBMA Interface

In a nonbroadcast multiaccess network, neighbors are not learned dynamically.

You can use the BCC or Site Manager to enable and disable the neighbor configuration, supply the IP address for each neighbor, and specify the neighbor's priority.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 5. Click on the OSPF interface to which you want to add a neighbor. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 6. Click on **Neighbors**. | The OSPF Neighbors window opens. |
| 7. Click on **Add**. | The OSPF Neighbor Configuration window opens. |
| 8. Set the **Neighbor's IP Address** parameter. Click on **Help** or see the parameter description on page A-83. | |
| 9. Click on **OK**. | Site Manager returns you to the OSPF Neighbors window. |
| 10. Set the following parameters:<br>• **Enable**<br>• **Priority**<br>Click on **Help** or see the parameter descriptions beginning on page A-84. | |
| 11. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the OSPF Interfaces window. |

# Defining an Area

You define an OSPF by setting parameters as described under the following topics:


| Topic | Page |
|---|---|
| Supplying an ID for the Area | 7-47 |
| Disabling and Reenabling an Area | 7-48 |
| Modifying an Area ID | 7-49 |
| Configuring Authentication | 7-49 |
| Configuring a Summary Route | 7-51 |
| Configuring a Stub Area | 7-52 |


## Supplying an ID for the Area

Each area has a unique identifier. You can use the BCC to supply the ID of the OSPF area you want to define.

Navigate to the OSPF global prompt and enter:

**area area-id** <*area-id*>

*area-id* is an area identifier in dotted-decimal notation.

To display area parameters and their current values, enter:

**info**

OSPF displays all area attributes and their current values.

For example, the following command sequence creates OSPF area 0.0.0.0 and displays area attributes:

```
ospf# area area-id 0.0.0.0
area/0.0.0.0# info
  on ospf
  state enabled
  area-id 0.0.0.0
  stub false
  authentication-type none
  stub-metric 1
  import-summaries true
area/0.0.0.0#
```

## Disabling and Reenabling an Area

When you define an OSPF area, the area is automatically enabled.

You can use the BCC and Site Manager to disable and reenable the area.

### *Using the BCC*

Navigate to the area-specific prompt and enter:

**state disabled**

For example, this command disables area 0.0.0.1:

```
area/0.0.0.1# state disabled
area/0.0.0.1#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Areas**. | The OSPF Areas window opens. |
| 5. Click on the area you want. | The parameter values for that area appear in the OSPF Areas window. |
| 6. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-84. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Modifying an Area ID

In an AS that contains multiple areas, you must assign a unique ID to each area.

You specify an ID when you define the area. You can use the BCC to change the ID.

### *Using the BCC*

Navigate to an OSPF interface prompt and enter:

**area** *<id>*

*id* is an area identifier expressed in dotted-decimal notation.

## Configuring Authentication

OSPF provides a measure of security for an area through the use of passwords. If an area is configured to use authentication, all OSPF interfaces configured in that area must be configured with a password. The password must be identical on each interface connected to the same network. Different networks can have different passwords.

In such an area, a router that receives a packet verifies the password before doing anything else with the packet. Unauthorized routers are not allowed to communicate with the OSPF system.

By default, authentication is disabled in an area. You can use the BCC or Site Manager to enable authentication and specify a password.

### *Using the BCC*

To enable authentication, navigate to the area-specific prompt and enter:

**authentication-type simplepassword**

If you have enabled authentication on the area, you can specify a password. Navigate to the OSPF interface-specific prompt and enter:

**authentication-key** *<string>*

*string* is any ASCII string up to eight characters long.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Areas**. | The OSPF Areas window opens. |
| 5. Click on the area you want. | The parameter values for that area appear in the OSPF Areas window. |
| 6. Set the **Authentication Type** parameter. Click on **Help** or see the parameter description on page A-85. | |
| 7. Click on **Apply**, and then click on **Done**.<br><br>If you chose **Simplepassword** as the **Authentication Type**, proceed to step 8 to specify a password; otherwise, you are done. | Site Manager returns you to the Configuration Manager window. |
| 8. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 9. Choose **IP**. | The IP menu opens. |
| 10. Choose **OSPF**. | The OSPF menu opens. |
| 11. Choose **Interfaces**. | The OSPF Interfaces window opens. |
| 12. Click on the OSPF interface. | The parameter values for that interface appear in the OSPF Interfaces window. |
| 13. Set the **Password** parameter. Click on **Help** or see the parameter description on page A-81. | |
| 14. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Configuring a Summary Route

Border routers generate summary advertisements for their attached areas. Each summary advertisement specifies a range of destinations in an area. An area range specification consists of a network address and a variable-length mask. For example, a summary advertisement for the destination 140.191.0.0 with a mask of 255.255.0.0 describes a single route to the collection of destinations 140.191.0.0 to 140.191.255.255. When a packet is forwarded, it is always forwarded to the network that is the best (longest or most specific) match for the packet's destination.

You can use the BCC or Site Manager to configure a summary route.

### *Using the BCC*

Navigate to the area-specific prompt and enter:

**summary network** *<ip_address>* **mask** *<ip_mask>*

*ip_address* and *ip_mask* are an IP address/mask pair defining the summary route.

For example, the following command sequence creates the summary route 140.191.0.0 with a mask of 255.0.0.0:

```
area/0.0.0.1# summary network 140.191.0.0 mask 255.0.0.0
summary/0.0.0.1/140.191.0.0#
```

By default, OSPF advertises the summary route. To change the setting, navigate to the summary-specific prompt and enter:

**action** *<action>*

*action* is one of the following:

**advertise** (the default)
**block**

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Areas**. | The OSPF Areas window opens. |
| 5. Click on the area for which you want to define a range. | The parameter values for that area appear in the OSPF Areas window. |
| 6. Click on **Ranges**. | The OSPF Ranges window opens. |
| 7. Click on **Add**. | The OSPF Range Area window opens. |
| 8. Set the following parameters:<br>• **Range Net**<br>• **Range Mask**<br>Click on **Help** or see the parameter descriptions beginning on page A-87. | |
| 9. Click on **OK**. | Site Manager returns you to the OSPF Ranges window. |

## Configuring a Stub Area

A stub area does not import ASEs and may or may not import internal route summaries. In place of routes to destinations outside the stub, a border router connected to a stub injects a default route advertisement. When an internal router encounters a datagram addressed to a destination outside the stub, the router forwards it to the border router specified in the default route advertisement.

Assume, for example, that the stub area in Figure 7-1 on page 7-5 has been configured to import no internal or external routing information. border router 8 receives ASEs and internal summaries from its interface to the backbone. However, border router 8 does not forward the ASEs or summaries to the stub. Instead, it injects a default route that internal routers use to forward datagrams to destinations beyond the stub.

### *Using the BCC*

By default, OSPF assumes that the area you define is not a stub area. If the area is a stub, navigate to the prompt for the area and enter:

**non-stub false**

By default, a border router that injects a default route into a stub area assigns a cost metric of 1 to that default route. To specify a different cost metric, enter:

**stub-metric** *<cost>*

*cost* is an integer.

By default, a border router injects network summaries into an attached stub area. To disable this function, enter:

**import-summaries false**

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Areas**. | The OSPF Areas window opens. |
| 5. Click on the area you want. | The parameter values for that area appear in the OSPF Areas window. |
| 6. Set the following parameters:<br>• **Import AS Extern**<br>• **Stub Default Metric**<br>• **Import Summaries**<br>Click on **Help** or see the parameter descriptions beginning on page A-86. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Configuring an Area Border Router

Each area is connected to the backbone by one or more border routers. In Figure 7-1 on page 7-5, for example, R3 is a border router connecting area 0.0.0.1 to the backbone. A border router can have connections to multiple areas. In Figure 7-6, for example, border router 2 has an interface to a network in area B and an interface to a network in area C.

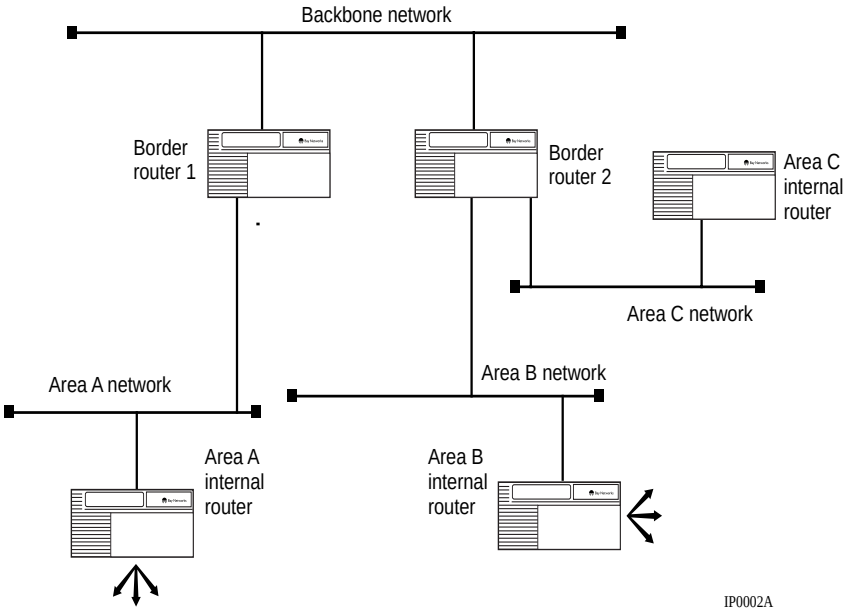


**Figure 7-6. Area Border Router**

Each border router in an AS does the following:

- Receives routing information from its attached areas, creates summaries of this information, and forwards the summaries to the backbone and to any other attached area. In Figure 7-6, for example, border router 2 floods summaries from area B to the backbone and area C. Through the backbone, the summaries are forwarded to all other areas in the AS.
- Receives (via the backbone) summaries from other border routers, uses this information to create new routing summaries (which add in the cost of the backbone routes), and forwards the new summaries to its attached areas.

By definition, a border router has an interface to the backbone and interfaces to one or more other areas. To configure OSPF as a border router:

1. **Assign the backbone ID (0.0.0.0) to an OSPF interface.**
2. **Assign an area ID to another OSPF interface.**

## Configuring a Virtual Backbone Link Through a Transit Area

Every border router must have a connection to the backbone. This connection can be physical or virtual.

If the border router has an interface to a backbone network, that router is considered to be physically connected to the backbone. In Figure 7-6, border router 1 and border router 2 are both physically connected to the backbone.

In some cases, it may not be possible to configure a border router with an interface to a backbone network. If the router has an OSPF neighbor that is physically connected to the backbone, the router can use that neighbor to establish a *virtual link* to the backbone.

In Figure 7-7, for example, border router 1 has lost its interface to the backbone network. In its place, the network administrator has configured an interface to a network in area B. Through this network, border router 1 now has a neighbor -- border router 2 -- that is connected physically to the backbone. The network administrator can use border router 2 to configure a virtual link between border router 1 and the backbone.

An area that provides a virtual link between a border router and the backbone is considered to be a *transit area*. In Figure 7-7, area B functions as a transit area.

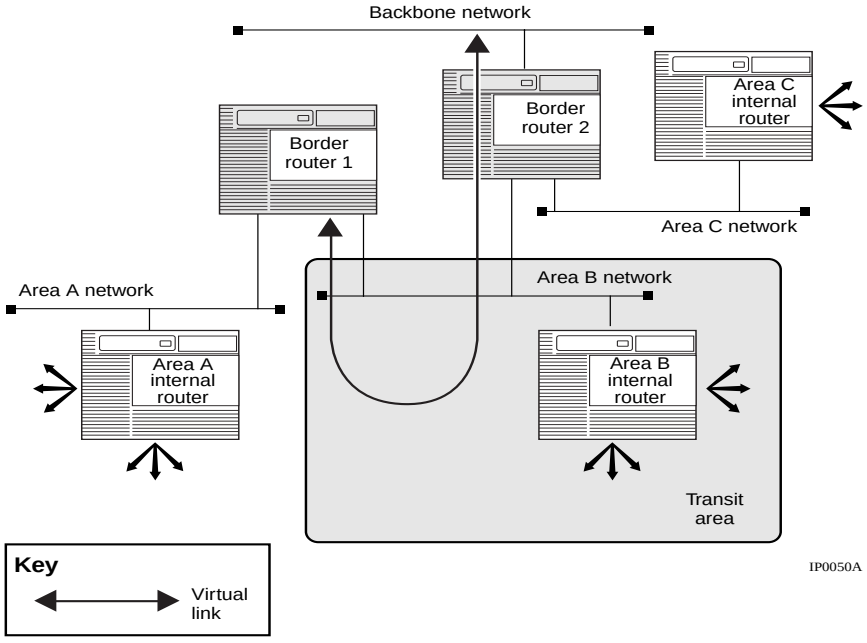


**Figure 7-7. Virtual Link and Transit Area**

To configure an interface to support a virtual link:

1. **Identify the transit area that supports the virtual link.**
2. **Identify the interface of the OSPF neighbor at the other end of the virtual link.**

Once you have defined the virtual link, you can:

- Enable and disable the virtual link.
- Specify a transit delay, a retransmit interval, a hello interval, and a dead interval for the link.
- Specify a password.

You can use Site Manager to configure a virtual link.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF menu opens. |
| 4. Choose **Virtual Interfaces**. | The OSPF Virtual Interfaces window opens. |
| 5. Click on the virtual interface you want to configure. | The parameter values for that interface appear in the OSPF Virtual Interfaces window. |
| 6. Set the following parameters:<br>• **Enable**<br>• **Transit Delay**<br>• **Retransmit Interval**<br>• **Hello Interval**<br>• **Dead Interval**<br>• **Password**<br>Click on **Help** or see the parameter descriptions beginning on page A-92. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Configuring OSPF Accept and Announce Policies

OSPF requires that all routers in a given area maintain a similar routing database. To ensure the integrity of the database, OSPF does not manipulate received link-state advertisements before propagating them on an interface.

There are two situations, however, in which an IP policy can be applied to an OSPF interface:

- An OSPF accept policy can be used on a router to control which OSPF non-self-originated external routing information is stored in the routing table. This accept policy controls only what the local router uses; it does not affect the propagation of non-self-originated external information to other routers.
- An OSPF announce policy can be used on a boundary router to control which self-originated external routing updates are placed in the link-state database for distribution according to the OSPF standard. The announce policy affects what other routers learn only with regard to the local boundary router's self-originated information.

In configuring a policy, IP operates according to the following rules:

- IP compares routing information against the *match* criteria in active policies.
- Once a match occurs, IP reviews other matching policies for *precedence.*
- IP applies the matching policy with the highest precedence to the routing information and takes the specified *action.*
- IP uses the values of any set criteria in the policy to change the content of the routing information.

The following topics show you how to configure OSPF policies:


| Topic | Page |
|---|---|
| Defining an OSPF Accept Policy | 7-59 |
| Supplying Modification Values for an OSPF Accept Policy | 7-62 |
| Specifying Matching Criteria for an OSPF Accept Policy | 7-64 |
| Defining an OSPF Announce Policy | 7-66 |
| Supplying Modification Values for an OSPF Announce Policy | 7-69 |
| Supplying Matching Criteria for an OSPF Announce Policy | 7-71 |

## Defining an OSPF Accept Policy

To define a new OSPF accept policy, you must do the following:

- Supply a name for the policy.
- Set the state of the policy (enabled or disabled).
- Specify whether OSPF accepts or ignores an update that matches the policy.
- Rank the policy according to preference, precedence, and other criteria.

You can use the BCC or Site Manager to define an OSPF accept policy.

### *Using the BCC*

To define a new OSPF accept policy, navigate to the OSPF global prompt and enter:

**accept** <*policy_name*>

*policy_name* is a unique name for the OSPF accept policy.

A policy-specific prompt appears, indicating that the BCC has created the policy using default values for all parameters.

For example, the following command creates an accept policy named accept_pol_1:

```
ospf# accept pol_1
accept/pol_1/ospf#
```

At the policy-specific prompt, enter:

*<parameter> <value>*

*parameter value* is one of the parameter/value pairs described in Table 7-7.

**Table 7-7. BCC Definition Parameters for OSPF Accept Policies**

| Parameter | Values | Function |
|---|---|---|
| state | Enabled (default)<br>Disabled | Enables and disables the policy you have created |
| action | Ignore (default)<br>Accept | Specifies whether the protocol ignores a route that matches the policy or forwards the route to the routing table manager |
| preference | 1 (default) to 16 | Assigns a metric value (the higher the number, the greater the preference) to a route that the protocol forwards to the routing table manager. If confronted with multiple routes to the same destination, the routing table manager may need to use this value to decide which route to insert. Routes for all networks (0.0.0.0/0.0.0.0) should have the lowest preference and routes for the most specific networks (longest address and mask) should have the highest preference. |
| precedence | 0 (default) to any integer | Assigns a metric value to this policy (a policy with a higher value takes precedence over a policy with a lower value). This value determines the order of precedence for policies that match the same route. |

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Accept**. | The OSPF Accept Policies window opens. |
| 6. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Route Preference**<br>• **Rule Precedence**<br>Click on **Help** or see the parameter descriptions in Appendix B. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Supplying Modification Values for an OSPF Accept Policy

You can use the BCC or Site Manager to supply values that OSPF uses to modify fields in an OSPF update that matches the policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**modify**

A modification prompt appears for the policy.

For example, the following command invokes a prompt for OSPF accept policy pol_1:

```
accept/pol_1/ospf# modify
modify/ospf/accept/pol_1#
```

To specify a value, enter:

*<parameter> <value>*

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Accept**. | The OSPF Accept Policies window opens. |
| 6. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Route Preference**<br>• **Rule Precedence**<br>• **Type**<br>• **Tag**<br>Click on **Help** or see the parameter descriptions beginning on pages B-2 and B-9. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying Matching Criteria for an OSPF Accept Policy

You can use the BCC or Site Manager to specify a match for the policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**match**

A match prompt appears for the policy.

For example, the following command sequence invokes a a match prompt for the OSPF accept policy pol_1:

```
accept/pol_1/ospf# match
match/ospf/accept/pol_1#
```

To specify matching criteria, enter:

*<match _criterion> <value>*

*match_criterion value* is one of the pairs shown in Table 7-8.

**Table 7-8. BCC Matching Criteria for OSPF Accept Policies**

| Parameter | Values | Function |
|---|---|---|
| ase-type | Any (default)<br>Type 1<br>Type 2 | Describes which type of OSPF ASE route matches this policy |
| ase-tag* | List of tag values | Specifies OSPF tag values that could be present in an OSPF ASE advertisement. This policy applies to OSPF ASE advertisements that contain the tag values on this list. |
| network* | List of IP addresses | Specifies a list of networks. This policy applies to the networks in this list. |

* The BCC implements this matching criterion as an object. To specify multiple elements, create multiple objects.

### *Using Site Manager*

Use this Site Manager procedure to create an OSPF accept policy.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Accept**. | The OSPF Accept Policies window opens. |
| 6. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Route Preference**<br>• **Rule Precedence**<br>• **Type**<br>• **Tag**<br>Click on **Help** or see the parameter descriptions beginning on pages B-2 and B-9. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Defining an OSPF Announce Policy

To define a new OSPF announce policy, you must do the following:

- Supply a name for the policy.
- Set the state of the policy (enabled or disabled).
- Specify whether OSPF advertises or ignores an update that matches the policy.
- Rank the policy according to precedence and other criteria.

You can use the BCC or Site Manager to define an OSPF announce policy.

### *Using the BCC*

To define a new OSPF announce policy, navigate to the BGP global prompt and enter:

**announce** <*policy_name*>

*policy_name* is a unique name for the announce policy.

A policy-specific prompt appears, indicating that the BCC has created the policy using default values for all parameters.

For example, the following command creates an announce policy named pol_1:

```
ospf# announce pol_1
announce/pol_1/ospf#
```

At the policy-specific prompt, enter:

*<parameter> <value>*

*parameter value* is one of the parameter/value pairs shown in Table 7-9.

**Table 7-9. BCC Definition Parameters for OSPF Announce Policies**

| Parameter | Values | Function |
|---|---|---|
| state | Enabled (default)<br>Disabled | Enables and disables the policy you have created |
| action | Ignore (default)<br>Accept | Specifies whether the protocol ignores a route that matches the policy or forwards the route to the routing table manager |
| precedence | 0 (default) to any integer | Assigns a metric value to this policy (a policy with a higher value takes precedence over a policy with a lower value). This value determines the order of precedence for policies that match the same route. |

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Announce**. | The OSPF Announce Policies window opens. |
| 6. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Rule Precedence**<br>• **Route Source**<br>• **External Route Source**<br>• **Advertise**<br>• **From RIP Gateway**<br>• **Received on RIP Interface**<br>• **RIP Metric**<br>• **From OSPF Router ID**<br>• **Received OSPF Type**<br>• **Received OSPF Tag**<br>• **From EGP Peer**<br>• **From EGP AS**<br>• **Received EGP Gateway**<br>• **From BGP Peer**<br>• **From BGP AS**<br>• **Received BGP Next Hop**<br>• **Type**<br>• **Tag**<br>• **Automatic Tag**<br>• **OSPF Metric**<br>Click on **Help** or see the parameter descriptions beginning on page B-25. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Supplying Modification Values for an OSPF Announce Policy

You can use the BCC or Site Manager to supply a value that OSPF uses to modify a field in an OSPF update that matches the policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**modify**

A modification prompt appears for the announce policy.

For example, the following command invokes a set prompt for the OSPF announce policy pol_1:

```
announce/pol_1/ospf# modify
modify/ospf/announce/pol_1#
```

To supply a value, enter:

*<parameter> <value>*

*parameter value* is one of the parameter/value pairs shown in Table 7-10.

**Table 7-10. BCC Modification Parameters for OSPF Announce Policies**

| Parameter | Values | Function |
|---|---|---|
| ase-tag | Null (default) or a tag value | Specifies a value for the OSPF external route tag field. If the outgoing route matches this policy, OSPF places this value in the field. |
| ase-type | 0 (default)<br>Type1<br>Type2 | Specifies an OSPF ASE metric type to use in advertisements for routes that match this policy |
| auto-tag | Disabled (default)<br>Enabled | Enables and disables BGP/OSPF automatic tag generation. Disable auto-tag generation if you want OSPF to use the value you specify with the ase-tag parameter. |
| metric | 0 (default) or an export metric | Specifies an optional OSPF metric to use when advertising a route that matches this policy |

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Announce**. | The OSPF Announce Policies window opens. |
| 6. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Rule Precedence**<br>• **Route Source**<br>• **External Route Source**<br>• **Advertise**<br>• **From RIP Gateway**<br>• **Received on RIP Interface**<br>• **RIP Metric**<br>• **From OSPF Router ID**<br>• **Received OSPF Type**<br>• **Received OSPF Tag**<br>• **From EGP Peer**<br>• **From EGP AS**<br>• **Received EGP Gateway**<br>• **From BGP Peer**<br>• **From BGP AS**<br>• **Received BGP Next Hop**<br>• **Type**<br>• **Tag**<br>• **Automatic Tag**<br>• **OSPF Metric**<br>Click on **Help** or see the parameter descriptions beginning on page B-25. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Supplying Matching Criteria for an OSPF Announce Policy

You can use the BCC or Site Manager to specify matching criteria for an OSPF announce policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**match**

A match prompt for the policy appears.

For example, the following command invokes a match prompt for the OSPF announce policy pol_1:

```
announce/pol_1/ospf# match
match/ospf/announce/pol_1#
```

To supply matching criteria, enter:

*<match_parameter> <value>*

*match_parameter value* is one of the parameter/value pairs shown in Table 7-11.

**Table 7-11. BCC Matching Parameters for OSPF Announce Policies**

| Parameter | Values | Function |
|---|---|---|
| protocol-source | Any (default)<br>Direct<br>Static<br>RIP<br>OSPF<br>EGP<br>BGP | Specifies one or more route source identifiers. If you select a route source ID, a route from that source that meets the other criteria of this policy matches the policy. |
| bgp-as* | List of AS numbers | Specifies one or more autonomous system numbers. This policy applies to BGP advertisements received from BGP peers in an AS on this list, and applies only to BGP-sourced routes and if BGP is included as a route source. |

*(continued)*

**Table 7-11. BCC Matching Parameters for OSPF Announce Policies** *(continued)*

| Parameter | Values | Function |
|---|---|---|
| bgp-next-hop* | List of IP addresses | Specifies one or more IP addresses. This policy applies to BGP advertisements whose Next Hop attribute matches an IP address on this list, and applies only to BGP-sourced routes and if BGP is included as a route source. |
| bgp-peer* | List of IP addresses | Specifies the IP address of one or more BGP peers. This policy applies to BGP advertisements authored by a router on this list, and applies only to BGP-sourced routes and if BGP is included as a route source. |
| egp-as* | List of AS numbers | Specifies one or more autonomous system numbers. This policy applies to EGP advertisements received from EGP peers in an AS on this list, and applies only to EGP-sourced routes and if EGP is included as a route source. |
| egp-gateway* | List of IP addresses | Specifies the IP address of one or more EGP gateways. This policy applies to EGP advertisements that use a gateway on this list as the next hop, and applies only to EGP-sourced routes and if EGP is included as a route source. |
| egp-peer* | List of IP addresses | Specifies the IP address of one or more EGP peers. This policy applies to EGP advertisements authored by a router on this list, and applies only to EGP source routes and if EGP is included as a route source. |
| inbound-interface* | List of IP addresses | Specifies the address of one or more interfaces on this router. This policy applies to RIP advertisements received on the interfaces in this list, and applies only to RIP-sourced routes and if RIP is included as a route source. |

*(continued)*

**Table 7-11. BCC Matching Parameters for OSPF Announce Policies** *(continued)*

| Parameter | Values | Function |
|---|---|---|
| network* | List of IP addresses | Specifies which networks will match this policy. Each identifier consists of a network number, a mask, and a flag to indicate whether the ID refers to a specific network or a range of networks. Enter a specific encoding of 0.0.0.0/0.0.0.0 to match the default route. Enter a range encoding of 0.0.0.0/0.0.0.0 to match any route. Enter an empty list to match any route. |
| ospf-router-id* | List of IP addresses | Specifies the IDs of one or more OSPF routers. This policy applies to OSPF advertisements authored by a router on this list, and applies only to OSPF-sourced routes and if OSPF is included as a route source. |
| ospf-tag* | List of OSPF ASE tag values | Specifies tag values that could be present in an OSPF ASE advertisement. This policy applies to OSPF ASE advertisements that contain tag values in this list, and applies only to OSPF-sourced ASE routes and if OSPF is included as a route source. |
| outbound-interface* | List of IP addresses | Specifies a list of outbound RIP interfaces. If an interface appears in this list, the policy applies to RIP advertisements sent via that interface. |
| rip-gateway* | List of IP addresses | Specifies the addresses of one or more routers that could send RIP updates to this router. This policy applies to RIP advertisements from routers on this list, and applies only to RIP-sourced routes and if RIP is included as a route source. |

* The BCC implements this matching criterion as an object. To specify multiple items, create multiple objects.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **OSPF**. | The OSPF window opens. |
| 4. Choose **Policies.** | |
| 5. Choose **Announce**. | The OSPF Announce Policies window opens. |
| 6. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Rule Precedence**<br>• **Route Source**<br>• **External Route Source**<br>• **Advertise**<br>• **From RIP Gateway**<br>• **Received on RIP Interface**<br>• **RIP Metric**<br>• **From OSPF Router ID**<br>• **Received OSPF Type**<br>• **Received OSPF Tag**<br>• **From EGP Peer**<br>• **From EGP AS**<br>• **Received EGP Gateway**<br>• **From BGP Peer**<br>• **From BGP AS**<br>• **Received BGP Next Hop**<br>• **Type**<br>• **Tag**<br>• **Automatic Tag**<br>• **OSPF Metric**<br>Click on **Help** or see the parameter descriptions beginning on page B-25. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Chapter 8
# Configuring and Customizing BGP

You configure and customize the Border Gateway Protocol (BGP) by setting BGP parameters as described under the following topics:


| Topic | Page |
|---|---|
| BGP Concepts and Terminology | 8-2 |
| Configuring BGP Globally | 8-11 |
| Establishing a Peer-to-Peer Session | 8-34 |
| Using the Circuitless IP Interface for a Peer-to-Peer Session | 8-58 |
| Configuring Peers over an Unnumbered Point-to-Point Link | 8-59 |
| Assigning Weight and Class Values to an AS | 8-61 |
| Configuring BGP Accept and Announce Policies | 8-63 |
| Configuring BGP Message Logging | 8-87 |
| Configuring IBGP as a Route Reflector or an RR Client | 8-88 |
| Configuring IBGP for Route and Traffic-Load Balancing | 8-100 |
| Configuring EBGP for Route and Traffic-Load Balancing | 8-106 |
| Configuring EBGP Route Flap Dampening | 8-111 |

# BGP Concepts and Terminology

BGP is an exterior gateway protocol designed to exchange network reachability information with other BGP systems in other autonomous systems.

Figure 8-1 shows two autonomous systems: AS1 and AS2. Networks within AS1 and AS2 are connected by routers running an interior gateway protocol -- in this case, OSPF. The two ASs are connected by routers that run an exterior gateway protocol -- BGP -- in addition to OSPF.

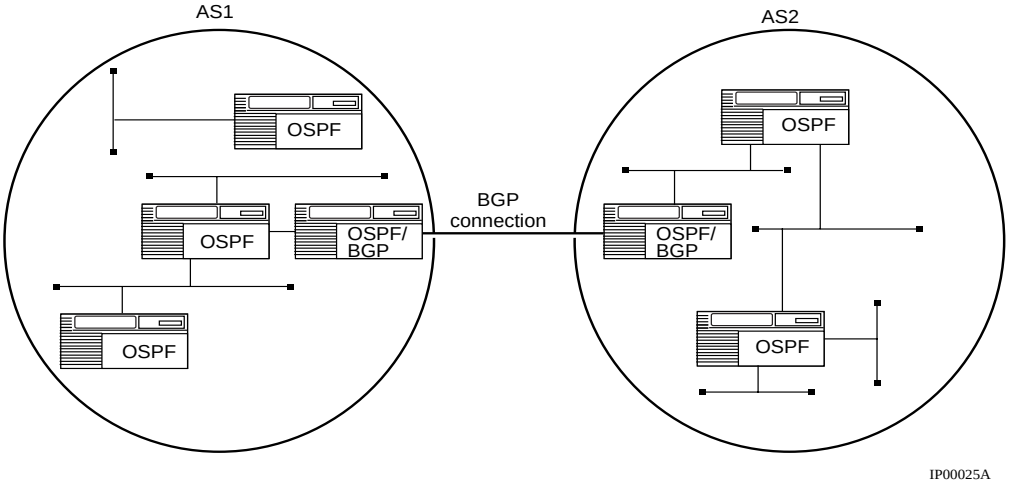


**Figure 8-1. BGP Connecting Autonomous Systems Running OSPF**

Bay Networks supports BGP-3 and BGP-4:

- BGP-3 assumes that each advertised network is a natural class network (A, B, or C) based on its high-order bits. BGP-3 cannot advertise subnets or supernets.
- BGP-4 has no concept of address classes. Each network listed in the Network Layer Reachability Information (NLRI) portion of an update message contains a prefix length field, which describes the length of the mask associated with the network. This allows for both supernet and subnet advertisement. The supernet advertisement is what makes classless interdomain routing (CIDR) possible.

This section covers the following topics:


| Topic | Page |
|---|---|
| Peer-to-Peer Sessions | 8-3 |
| Stub and Multihomed Autonomous Systems | 8-4 |
| Interior BGP Routing | 8-4 |
| IBGP Route Reflector | 8-5 |
| BGP Updates | 8-6 |
| BGP-4 Local Preference Calculation | 8-8 |
| Best-Route Selection | 8-9 |
| BGP/OSPF Interaction | 8-9 |
| BGP Implementation Notes | 8-10 |


## Peer-to-Peer Sessions

A BGP router employs a BGP speaker, which is an entity within the router that transmits and receives BGP messages and acts upon them. A BGP speaker forms a neighbor relationship with another BGP speaker by establishing a *peer-to-peer session*. For instructions, see “Establishing a Peer-to-Peer Session” on page 8-34.

## Stub and Multihomed Autonomous Systems

An autonomous system can include one or more BGP speakers that establish peer-to sessions with BGP speakers in other autonomous systems to provide external route information for the networks within the AS. An AS containing multiple BGP speakers is considered to be a *multihomed AS.* An AS containing a single BGP speaker that establishes a peer-to-peer session with a single external BGP speaker is a *stub AS.* The BGP speaker provides external route information for the networks contained within its AS only.

## Interior BGP Routing

Bay Networks implements Interior BGP (IBGP) intra-AS routing. Under IBGP, each router in the AS runs an interior gateway protocol (IGP) for internal routing updates and also maintains an IBGP connection to each BGP border router. The IBGP information is used in conjunction with the IGP route to the authoring BGP border router to determine the next hop to use for external networks.

No BGP information is carried by the IGP. Each router uses IBGP exclusively to determine reachability to external networks. When an IBGP update for a network is received, it can be passed on to IP for inclusion in the routing table only if a viable IGP route to the correct border gateway is available.

An AS with more than one BGP speaker can use IBGP to provide a transit service for networks outside the AS. An AS that provides such a service for BGP speakers is known as a *transit AS* (Figure 8-2).

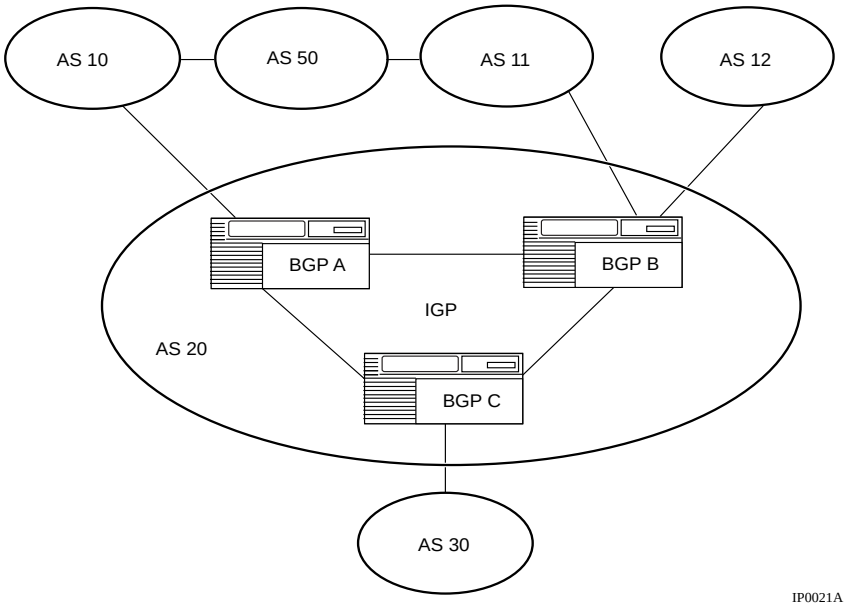


**Figure 8-2. Transit Autonomous System (AS)**

In Figure 8-2, AS 20 is the transit AS. It provides information about its internal networks, as well as transit networks, to the remaining ASs. The IBGP connections between BGP routers A, B, and C are necessary to provide consistent information to the ASs.

## IBGP Route Reflector

A BGP router configured for internal BGP (IBGP) must establish a peer-to-peer session with every other IBGP speaker in the AS. In an AS with a large number of IBGP speakers, this *full-mesh topology* can result in high bandwidth and maintenance costs. For example, a full-mesh topology for an AS with 50 IBGP speakers requires 1,225 internal peer-to-peer connections.

To avoid the high costs of a full-mesh topology to support IBGP speakers within a large AS, you can configure a router to function as an *IBGP route reflector*. IBGP speakers that need to communicate with other BGP speakers in the AS establish a single peer-to-peer client session with the route reflector.

For information about the IBGP route reflector, see “Configuring IBGP as a Route Reflector or an RR Client” on page 8-88.

## BGP Updates

BGP-3 and BGP-4 speakers exchange routing information in the form of routing updates that include a network number and a list of autonomous systems that the routing information has passed through (the AS path).

In addition, an update includes the following:

- List of path attributes
- Local preference value (BGP-4 only)

### Path Attributes

A BGP-3 update message includes a variable-length sequence of path attributes. Each attribute entry consists of an attribute value and a field describing the attribute. Table 8-1 describes the mandatory and optional BGP-3 path attributes.

**Table 8-1. BGP-3 Path Attributes**

| Attribute | Description |
|---|---|
| AS path | Mandatory attribute containing a list of the ASs that must be traversed to reach the given destinations |
| Origin | Mandatory attribute containing one of the following values:<br>• IGP (the path is valid all the way to the IGP of the originating AS)<br>• EGP (the path was advertised using EGP by the last AS in the AS path)<br>• Incomplete (the path is valid only to the last AS in the AS path) |
| Next hop | Mandatory attribute that defines the IP address of the router to use as a next hop for the advertised destinations |
| Inter-AS | Optional attribute used to choose between paths to the destinations listed |
| Unreachable | Discretionary attribute used to indicate destinations that have become unreachable |

The BGP-4 update message has the same format and contains the same mandatory attributes as the BGP-3 update message with the following additions:

- In place of the unreachable attribute that BGP-3 includes as part of the path attribute description, the BGP-4 update includes an unreachable field. This field specifies destinations that have become unreachable.
- In place of the BGP-3 optional attributes, a BGP-4 update message can include the optional attributes described in Table 8-2.

**Table 8-2. BGP-4 Optional Path Attributes**

| Attribute | Description |
|---|---|
| Multiexit discriminator | Chooses between paths to the destinations listed |
| Local preference | Allows AS border routers to indicate the preference they have assigned to a chosen route when advertising it to IBGP peers |
| Atomic aggregate | Ensures that certain network layer reachability information (NLRI) is not deaggregated |
| Aggregator | Identifies which AS performed the most recent route aggregation. The attribute contains the last AS number that formed the aggregate route followed by the IP address of the BGP speaker that formed the aggregate route. |
| Route clusters | Lists the route clusters that may be traversed to reach a given destination |
| Advertiser | Identifies which border router injected the route |
| BGP community | Identifies the communities to which the route belongs. (A community is a group of destinations that share some common property.) |

## BGP-4 Local Preference Calculation

BGP-4 update messages include a local preference attribute that allows an AS border router to assign a preference value to a route when advertising it to IBGP peers. The calculation of the local preference attribute is specific to each implementation. A higher value indicates that the route is more preferred.

The router uses the following equation to calculate a value for the local preference attribute:

*local preference* = 8191 - *origin value* - *AS path weight*

where *origin value* is 0 for routes with an origin path attribute of IGP or 4096 for other routes, and *AS path weight* is a sum of weight values associated with AS numbers listed in the route's AS Path attribute. These weight values can be configured and default to 8.

A steep penalty is applied to routes that are advertised with an origin attribute other than IGP -- that is, EGP or incomplete.

For an OSPF internal route or a direct route, the local preference attribute is set to:

*local preference* = (8191 + 256 - (*metric* & 255))

where *metric* is the OSPF metric for an OSPF route or the configured cost for a direct route.

For a RIP route, an EGP route, an OSPF ASE route, or a static route, the local preference attribute is set to:

*local preference* = (256 - *metric*)

where *metric* is the RIP metric for a RIP route, the EGP metric for an EGP route, the OSPF metric for an OSPF ASE route, or the configured cost for a static route.

Note that local preference values for OSPF internal routes and direct routes are higher than the local preference values calculated for BGP routes.

## Best-Route Selection

BGP uses the following rules (tie breakers) to select the best BGP route:

- Choose the route with the lower route weight.
- Choose the route with the higher local preference attribute.
- Choose the route with the lower multiexit discriminator (MED) attribute (if both routes include this optional attribute).
- Choose the route with the lower interior cost to the next hop.
- Choose external BGP over IBGP.
- Choose the route with the lower BGP identifier.
- Choose the route with the lower BGP connection remote address.
- Choose the route with the lower BGP connection local address.

## BGP/OSPF Interaction

RFC 1403 defines the interaction between BGP and OSPF when OSPF is the IGP within an autonomous system. For routers running both protocols, the OSPF router ID and the BGP identifier must be an IP address and must be identical. A route policy must be configured to allow BGP advertisement of OSPF routes.

Interaction between BGP-4 and OSPF includes the ability to advertise supernets to support classless interdomain routing (CIDR). BGP-4 allows interdomain supernet advertisements; OSPF can carry supernet advertisements within a routing domain.

## BGP Implementation Notes

This section provides guidelines that you should follow when you configure BGP. If you do not follow these guidelines, BGP either will not work efficiently or will become disabled on the interfaces involved. The guidelines are as follows:

- BGP will not operate with an IP router in nonforwarding (host-only) mode. Make sure that the routers you want BGP to operate with are in forwarding mode.
- If you are using BGP for a multihomed AS (one that contains more than one exit point), Bay Networks strongly encourages you to use OSPF for your IGP and BGP for your sole exterior gateway protocol, or use intra-AS IBGP routing.

  If OSPF is the IGP, you should also use the default OSPF tag construction. Using EGP or modifying the OSPF tags makes network administration and proper construction of BGP path attributes more difficult.
- For any router supporting both BGP and OSPF, the OSPF router ID and the BGP identifier must be the same.

# Configuring BGP Globally

You configure BGP by setting BGP parameters as described under the following topics:


| Topic | Page |
|---|---|
| Enabling and Disabling BGP | 8-12 |
| Supplying a BGP Identifier | 8-14 |
| Identifying the Local AS | 8-15 |
| Disabling and Reenabling IBGP Support | 8-16 |
| Specifying Route Types for IBGP Advertisements | 8-17 |
| Setting the Update Interval Timer | 8-19 |
| Allowing Redundant Connections | 8-20 |
| Enabling Multihop Connections | 8-21 |
| Disabling and Reenabling Dynamic Policy Configuration | 8-23 |
| Configuring BGP as a Soloist | 8-24 |
| Associating a Route Reflector with a Cluster ID | 8-26 |
| Disabling and Reenabling Route Aggregation | 8-26 |
| Enabling and Disabling Black Hole Punching | 8-27 |
| Disabling and Reenabling the BGP-4 MED Attribute | 8-30 |
| Disabling BayRS Local Preference Calculation and Route Selection | 8-32 |

## Enabling and Disabling BGP

When you start BGP on the router, BGP is automatically enabled for both BGP-3 and BGP-4 peer-to-peer connections.

You can use the BCC and Site Manager to disable and reenable BGP on the router. You can also use Site Manager to disable and reenable BGP-3 and BGP-4.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**state** *<state>*

*state* is one of the following:

**enabled** (default)
**disabled**

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **BGP Enable** parameter. Click on **Help** or see the parameter description on page A-3. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |
| 7. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 8. Choose **IP**. | The IP menu opens. |
| 9. Choose **BGP**. | The BGP menu opens. |
| 10. Choose **BGP-3 Global**. | The Edit BGP-3 Global Parameters menu opens. |
| 11. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-10. | |
| 12. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |
| 13. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 14. Choose **IP**. | The IP menu opens. |
| 15. Choose **BGP**. | The BGP menu opens. |
| 16. Choose **BGP-4 Global**. | The Edit BGP-4 Global Parameters window opens. |
| 17. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-10. | |
| 18. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Supplying a BGP Identifier

The BGP identifier is the IP address of an interface on this router.

There is no default for this parameter. You must supply a BGP ID, using the IP address of one of the router's IP interfaces.

You can use the BCC or Site Manager to supply a BGP identifier for the router.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**router-id** *<ip_address>*

*ip_address* is the address of one of the IP interfaces on the router.

For example, the following command supplies IP address 2.2.2.2 for the BGP identifier:

```
bgp# router-id 2.2.2.2
bgp#
```

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **BGP Identifier** parameter. Click on **Help** or see the parameter description on page A-4. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Identifying the Local AS

Each autonomous system in the internet has a unique AS ID.

You can use the BCC or Site Manager to supply the ID of the AS in which the BGP router is located.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**local-as** *<local_as>*

*local_as* is the number of the AS in which the router is located.

For example, the following command specifies AS 5 as the local AS:

```
bgp# local-as 5
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **BGP Local AS** parameter. Click on **Help** or see the parameter description on page A-4. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Disabling and Reenabling IBGP Support

By default, BGP supports IBGP intra-AS sessions. (For information, see “Interior BGP Routing” on page 8-4.)

A BGP transit AS should use IBGP intra-AS routing. A stub or multihomed AS usually does not use IBGP routing.

You can use the BCC or Site Manager to disable and reenable the feature.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**intra-as-routing** *<state>*

*state* is one of the following:

**enabled** (default)
**disabled**

For example, the following command disables IGBP:

```
bgp# intra-as-routing disabled
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **BGP Intra-AS** parameter. Click on **Help** or see the parameter description on page A-4. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Specifying Route Types for IBGP Advertisements

If IBGP is enabled, you can specify the types of routes that BGP advertises in IBGP sessions. By default, IBGP propagates only routes learned from external BGP peers. You can use Site Manager to configure IBGP to propagate routes learned from all route sources (excluding IBGP and OSPF interarea and intra-area routes, which IBGP never advertises).

You can use the BCC or Site Manager to specify the route type for IBGP advertisements.

### *Using the BCC*

Navigate to the BGP global prompt and enter:

**redistribute-protocols** <*protocols*>

*protocols* is one of the values listed in Table 8-3.

**Table 8-3. Route Types for BGP Advertisements**

| Route Type | Meaning |
|---|---|
| BGP (default) | BGP propagates routes learned from external BGP peers. |
| All | BGP propagates routes from all route sources. |

For example, the following command configures BGP to advertise routes from all route sources:

```
bgp# redistribute-protocols all
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **BGP From Protocols** parameter. Click on **Help** or see the parameter description on page A-5. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Setting the Update Interval Timer

BGP injects external BGP routes into the routing table. The default minimum interval between route injections is 5 seconds.

You can use the BCC or Site Manager to specify the minimum number of seconds between route injections.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**inject-time** <*seconds*>

*seconds* is the minimum interval between route injections.

For example, the following command causes BGP to inject external BGP routes into the routing table with a minimum interval of 10 seconds:

```
bgp# inject-time 10
bgp#
```

### *Using Site Manager*

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **BGP Interval Timer** parameter. Click on **Help** or see the parameter description on page A-5. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Allowing Redundant Connections

By default, BGP performs redundancy checking on peer-to-peer TCP sessions. BGP can maintain only one TCP session with a remote BGP peer. If the remote peer attempts to establish another session on another physical connection, BGP rejects the session. BGP uses a collision-detection method based on the router ID to check for redundant sessions.

The advantage of a peer-to-peer configuration with multiple sessions on multiple physical connections is redundancy -- if one connection fails, the peers can communicate over another link. The disadvantage is that such a configuration results in multiple copies of each route.

You can use the BCC or Site Manager to disable redundancy checking to allow TCP sessions with the same remote peer on multiple physical connections.

You can also use the BCC to specify the maximum number of redundant routes that BGP allows. By default, BGP allows up to 255 redundant routes.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**redundant-connection** <*state*>
**max-redundant-routes** <*max_routes*>

*state* is one of the following:

**enabled** (default)
**disabled**

*max_routes* is the maximum number of redundant routes.

For example, the following command disables BGP redundancy checking, allowing BGP to establish multiple TCP sessions (on different physical connections) with the same remote peer:

```
bgp# redundant-connection disabled
bgp#
```

The following command configures BGP to allow up to 50 redundant routes:

```
bgp# max-redundant-routes 50
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **BGP Collision Detect** parameter. Click on **Help** or see the parameter description on page A-6. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Enabling Multihop Connections

By default, BGP enforces the one-hop rule for BGP peers -- the remote peer must be located on a directly attached network.

You can use the BCC or Site Manager to override the restriction and allow multihop connections.

You can configure each peer in the multihop session with a TTL value that IP uses as the hop count limit for forwarding packets during the session. (See “Setting the TTL Counter on an Update” on page 8-57.)

**Caution:** Enabling multihop BGP connections is dangerous because it can cause BGP speakers to establish a BGP connection that traverses a third-party AS, which may violate policy considerations and may also introduce forwarding loops.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**multi-hop** <*state*>

*state* is one of the following:

**enabled**
**disabled** (default)

For example, the following command enables BGP for multihop peer-to-peer connections:

```
bgp#  multi-hop enabled
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **Multi-hop EBGP Connection** parameter. Click on **Help** or see the parameter description on page A-6. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Disabling and Reenabling Dynamic Policy Configuration

By default, BGP reconfigures IP policies dynamically. This means that if you modify a policy, BGP dynamically reevaluates all affected routes in the light of the modified policy. BGP then sends the appropriate withdraw or update to the affected peers. BGP maintains records of which routes have been sent to which peer, allowing for precise determination of which routes must be sent and which must be withdrawn.

If you modify an IP policy with this feature disabled, BGP restarts all BGP connections. There is no advantage to disabling dynamic policy configuration. Disabling this parameter will significantly impact BGP protocol operation overhead and network stability.

You can use the following Site Manager procedure to disable and reenable dynamic policy configuration:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **BGP Dynamic Policy Change Support** parameter. Click on **Help** or see the parameter description on page A-7. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring BGP as a Soloist

By default, BGP runs as a soloist on a slot determined by the BGP soloist slot mask. Bay Networks recommends that the slot mask include only nonforwarding slots, so that BGP operations (route calculation, for example) occur on one slot while the other slots maintain maximum forwarding capability.

If the slot on which the soloist is running fails, BGP runs on an eligible slot. By default, BGP considers all slots with IP interfaces to be eligible slots. You can use the BCC or Site Manager to specify a slot for the BGP soloist.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**slot-mask** <*slot*>

*slot* is one of the values listed in Table 8-4.

**Table 8-4. Slot Mask Parameter Values**

| Value | Meaning |
|---|---|
| all-slots (default) | BGP runs on all slots. (BGP is not a soloist.) |
| 1 to 14 | BGP is a soloist running on the specified slot. |

For example, the following command causes BGP to run as a soloist on slot 5:

```
bgp# slot-mask 5
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **BGP Soloist Slots** parameter. Click on **Help** or see the parameter description on page A-7. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Associating a Route Reflector with a Cluster ID

In an AS with multiple clusters of route reflectors, you assign a cluster ID to each cluster and associate each route reflector with a cluster.

For information about the IBGP route reflector, see “Configuring IBGP as a Route Reflector or an RR Client” on page 8-88.

## Disabling and Reenabling Route Aggregation

By default, BGP aggregates non-BGP-originated subnet routes to their corresponding natural network routes for advertisement to BGP peers.

You can use Site Manager or the BCC to disable this feature. (This switch does not affect the advertisement of BGP-originated routes.)

### *Using the BCC*

Navigate to the BGP prompt and enter:

**subnet-aggregation** <*state*>

*state* is one of the following:

**enabled** (default)
**disabled**

For example, the following BCC command disables subnet aggregation:

```
bgp# subnet-aggregation disabled
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **Aggregate Subnets** parameter. Click on **Help** or see the parameter description on page A-8. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Enabling and Disabling Black Hole Punching

If BGP advertises aggregate routes, you can configure BGP to submit each aggregate route to the routing table as a *black hole*. If IP receives a packet that does not match any of the explicit subnet routes, the black hole route causes it to discard the packet. (For more information about black hole routes, see “Defining a Static Black Hole for a Supernet” on page 4-62.)

By default, BGP does not submit a black hole route to the IP routing table for an aggregate route that it advertises to a BGP peer.

You can use the BCC or Site Manager to enable this feature. You can also configure IP to return an ICMP destination unreachable message to the sender of a packet to an unknown destination.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**black-hole-punching** <*action*>

*action* is one of the values described in Table 8-5.

**Table 8-5. Black Hole Punching Parameter Settings**

| Value | Meaning |
|---|---|
| disabled (default) | Disables black hole punching |
| drop | Enables black hole punching. IP drops packets for an unknown destination without returning an ICMP message to the sender. |
| reject | Enables black hole punching. IP drops packets for an unknown destination and returns a destination unreachable message to the sender. |

For example, the following command line causes BGP to submit aggregate routes to the routing table as black hole routes IP drops packets for unknown destinations but does not return ICMP destination unreachable messages to the sender:

```
bgp# black-hole-punching drop
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **Black Hole Routes** parameter. Click on **Help** or see the parameter description on page A-8. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Disabling and Reenabling the BGP-4 MED Attribute

By default, BGP-4 considers the multiexit discriminator (MED) attribute in the route selection process (see Table 8-2 on page 8-7).

You can use the BCC or Site Manager to configure BGP-4 so that it disregards the MED attribute in the route selection process.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**med-comparison** <*state*>

*state* is one of the following:

**enabled** (default)
**disabled**

For example, the following command causes BGP-4 to disregard the MED attribute in an update when selecting a route:

```
bgp# med-comparison disabled
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **Route with MED** parameter. Click on **Help** or see the parameter description on page A-9. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Disabling BayRS Local Preference Calculation and Route Selection

A BGP speaker calculates a local preference value for each route that it receives from an external peer, and passes this value as the local_pref attribute in routing updates that it announces to its internal BGP (IBGP) peers. A BGP speaker that receives a routing update from an IBGP peer uses the local_pref attribute in its best-route selection process.

By default, BGP calculates a local-preference value by using the algorithm described in “BGP-4 Local Preference Calculation” on page 8-8. The best-route selection process is described in “Best-Route Selection” on page 8-9.

Different implementations of BGP have different ways of arriving at a local preference value. However, within an AS, all BGP speakers should use the same method to determine local preference and to select the best routes. If you are configuring BayRS BGP in a network that also includes routers from other vendors, you can use the BCC or Site Manager to disable BayRS local-preference calculation and route selection. Instead, BGP assigns a value of 100 to externally received routes and uses the following formula for best-route selection:

1. If the next hop is inaccessible, do not consider it.
2. Consider larger BGP administrative weights first.
3. If the routers have the same weight, consider the route with the highest local preference.
4. If the routes have the same local preference, prefer the route that the local router originated.
5. If no route was locally originated, prefer the shorter AS path.
6. If the routes have the same AS path length, prefer the lowest origin code (IGP is preferred over EGP, which is preferred over incomplete.).
7. If the origin codes are the same and all paths come from the AS, prefer the path with the lowest multiexit discriminator (MED) metric. Treat a missing MED metric as 0.
8. If the MED metrics are the same, prefer external paths over internal paths.
9. If IGP synchronization is disabled and only internal paths remain, prefer the path through the closest neighbor.
10. Prefer the route with the lowest IP address value for the BGP router ID.

### *Using the BCC*

Navigate to the BGP global prompt and enter:

**local-pref-calculation** <*state*>

*state* is one of the values shown in Table 8-6.

**Table 8-6. Local Preference Calculation Method**

| State | Meaning |
|---|---|
| Enabled (default) | BGP uses BayRS formulas for local-preference calculation and best-route selection. |
| Disabled | BGP does not perform local-preference calculation. Instead, it assigns a value of 100 to the route and uses a modified formula for best-route selection. |

For example, the following command disables BayRS BGP local-preference calculation and route selection:

```
bgp# local-pref-calculation disabled
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **Local Pref Calculation** parameter. Click on **Help** or see the parameter description on page A-9. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

# Establishing a Peer-to-Peer Session

A BGP speaker forms neighbor relationships with other BGP speakers. This happens when a BGP speaker establishes a TCP connection to a BGP peer (which is simply the BGP speaker at the other end of the connection), based on local configuration information.

You establish a BGP peer-to-peer session by setting BGP parameters as described under the following topics:


| Topic | Page |
|---|---|
| Defining a Peer-to-Peer Session | 8-35 |
| Initiating a Peer-to-Peer Session | 8-37 |
| Negotiating the BGP Version | 8-39 |
| Keeping the Connection Alive | 8-41 |
| Setting the External Advertisement Timer | 8-43 |
| Specifying a Holddown Time | 8-45 |
| Setting a Minimum AS Origination Interval | 8-47 |
| Overriding the Local AS Number | 8-49 |
| Specifying a Maximum Update Size | 8-50 |
| Setting the Route Echo Switch | 8-52 |
| Disabling and Reenabling Loop Detection | 8-54 |
| Specifying the Route Reflector Mode of the Remote Peer | 8-56 |
| Setting the Backoff Timer on an IBGP Route Server | 8-56 |
| Setting the TTL Counter on an Update | 8-57 |

## Defining a Peer-to-Peer Session

To define a peer-to-peer session, you specify the following:

- The address of the local IP interface
- The address of the remote IP interface
- The AS number of the autonomous system in which the remote BGP peer is located

If the remote peer is located in a different AS from the local peer, the remote address must be on the same subnet as the local address. (To override this restriction, see "Enabling Multihop Connections" on page 8-21.)

If the local peer and the remote peer are located in the same AS, BGP assumes that you are configuring an IBGP session and does not impose this restriction.

You can use the BCC or Site Manager to supply this information.

### *Using the BCC*

Navigate to the BGP prompt and enter:

**peer local** *<local_address>* **remote** *<remote_address>* **as** *<as_number>*

*local_address* is the IP address of the local interface.

*remote_address* is the IP address of the remote interface.

*as_number* is the number of the AS in which the remote peer is located.

For example, the following command defines a session with a remote peer in AS 5. The local IP interface is 2.2.2.2. The interface for the remote peer is 2.2.2.5.

```
bgp# peer local 2.2.2.2 remote 2.2.2.5 as 5
peer/2.2.2.2/2.2.2.5/5#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on **Add**. | The BGP Peer Parameters window opens. |
| 8. Set the following parameters:<br>• **Peer Address**<br>• **Peer AS**<br>• **Local Address**<br>• **Peer RS Mode**<br>Click on **Help** or see the parameter descriptions beginning on page A-10. | |
| 9. Click on **OK**. | Site Manager returns you to the BGP Peer List window. |
| 10. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Initiating a Peer-to-Peer Session

A BGP speaker that wants to initiate a peer-to-peer connection periodically issues an open message.

BGP speakers respond to connection requests by returning open messages. In Figure 8-3, for example, BGP speaker A sends an open message to BGP speaker B to request a connection; BGP speaker B responds by sending an open message to BGP speaker A.

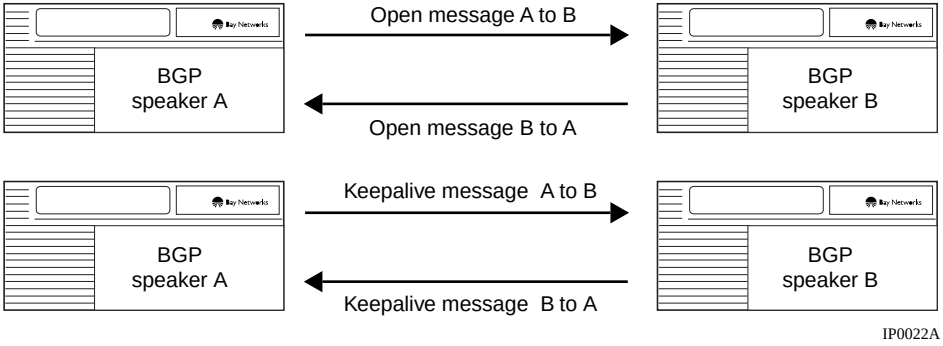


**Figure 8-3. Establishing and Confirming a Connection Between BGP Peers**

All BGP speakers respond to connection requests from other speakers.

By default, BGP attempts to initiate a connection on each interface configured for peer-to-peer communications. If the attempt is unsuccessful, BGP retries every 120 seconds.

You can use the BCC or Site Manager to specify a retry interval or disable the initiation function.

### *Using the BCC*

Navigate to a BGP peer prompt and enter:

**retry** <*interval*>

*interval* is the number of seconds between attempts to initiate a peer-to-peer session.

For example, the following command causes BGP to retry every 60 seconds to establish a peer-to-peer session between IP interface 2.2.2.2 and 2.2.2.3:

```
peer/2.2.2.2/2.2.2.3# retry 60
peer/2.2.2.2/2.2.2.3#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **Connect Retry Timer** parameter. Click on **Help** or see the parameter description on page A-13. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Negotiating the BGP Version

BGP peers negotiate the version of BGP that they will use to exchange routing information. If you enable both BGP-3 and BGP-4, the router first attempts to use BGP-4. If the BGP peer is not a BGP-4 speaker, the router uses BGP-3.

By default, BGP considers BGP-4 as both the minimum and maximum acceptable version for negotiation.

You can use the BCC or Site Manager to specify BGP-3 as the minimum or maximum acceptable version.

### *Using the BCC*

To specify the minimum version, navigate to a BGP peer prompt and enter:

**min-version** <*version*>

*version* is one of the following:

**bgp3**
**bgp4** (default)

To specify the maximum version, navigate to a BGP peer prompt and enter:

**max-version** <*version*>

*version* is one of the following:

**bgp3**
**bgp4** (default)

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the following parameters:<br>• **Min BGP Version**<br>• **Max BGP Version**<br>Click on **Help** or see the parameter descriptions beginning on page A-12. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Keeping the Connection Alive

After a session has been established, BGP peers periodically issue keepalive messages to maintain the connection. By default, BGP issues a keepalive message every 30 seconds.

You can use the BCC or Site Manager to specify how often BGP issues a keepalive message on this peer-to-peer session or to disable the keepalive function.

### *Using the BCC*

Navigate to a BGP peer prompt and enter:

**keepalive** <*seconds*>

*seconds* indicates how often BGP sends a keepalive message on this peer session.

For example, the following command causes BGP to send a keepalive message every 10 seconds on interface 2.2.2.2 to the peer at 2.2.2.5:

```
peer/2.2.2.2/2.2.2.5/5# keepalive 10
peer/2.2.2.2/2.2.2.5/5#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **Keepalive Timer** parameter. Click on **Help** or see the parameter description on page A-14. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Setting the External Advertisement Timer

After a connection is established, the BGP speaker uses one or more update messages to send the entire IP routing table (compliant with local BGP export policies). BGP, however, does *not* require the entire routing table to be sent again. Therefore, the BGP speaker must keep a current version of the routing information received from of all of its peers for as long as the connection to each peer is valid. This information is updated via update messages whenever changes occur.

By default, BGP examines the routing table for changes every 5 seconds. If a change has occurred, BGP issues an update message on the connection.

You can use the BCC or Site Manager to specify a value for the external advertisement timer.

### *Using the BCC*

Navigate to a BGP peer-specific prompt and enter:

**advertise-time** <*seconds*>

*seconds* is an integer specifying how often BGP issues an update message on this peer session.

For example, the following command sets the external advertisement timer to 20 seconds for the peer session established between interfaces 2.2.2.2 and 2.2.2.5:

```
peer/2.2.2.2/2.2.2.5/5# advertise-time 20
peer/2.2.2.2/2.2.2.5/5#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **External Advertisement Timer** parameter. Click on **Help** or see the parameter description on page A-13. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Specifying a Holddown Time

The holddown time is the amount of time either peer will wait for a keepalive or update message before declaring the connection down.

A BGP speaker that initiates a connection inserts a holddown time value into the open message. The responding peer responds with an open message that also contains a holddown time value. If the BGP speakers establish a session, they use the lesser value (which must be greater than 2). There are two exceptions to this rule:

- If one peer sends a zero holddown time, the peers use the nonzero holddown time on the session.
- If both peers send zero holddown times, the peers observe no holddown time on the session.

By default, BGP inserts a value of 90 seconds into the open message.

You can use the BCC or Site Manager to specify a holddown time value or disable the holddown function.

### *Using the BCC*

Navigate to a BGP peer-specific prompt and enter:

**holddown** <*seconds*>

*seconds* is an integer indicating the number of seconds that BGP waits for a keepalive message before declaring the connection down.

For example, the following command sets the holddown timer to 60 seconds for the peer session established between interfaces 2.2.2.2 and 2.2.2.5:

```
peer/2.2.2.2/2.2.2.5/5# holddown 60
peer/2.2.2.2/2.2.2.5/5#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **Holdtime** parameter. Click on **Help** or see the parameter description on page A-14. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Setting a Minimum AS Origination Interval

By default, a BGP speaker that issues an update to advertise a change in the AS must wait at least 15 seconds before advertising a subsequent change.

You can use the BCC or Site Manager to specify a different interval.

### *Using the BCC*

Navigate to a BGP peer-specific prompt and enter:

**min-originate-time** <*seconds*>

*seconds* is an integer indicating the minimum number of seconds that BGP waits between advertisements.

For example, the following command causes BGP to wait at least 30 seconds between updates on the peer session established between interfaces 2.2.2.2 and 2.2.2.5:

```
peer/2.2.2.2/2.2.2.5/5# min-originate-time 30
peer/2.2.2.2/2.2.2.5/5#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **Min AS Origination Interval** parameter. Click on **Help** or see the parameter description on page A-15. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Overriding the Local AS Number

By default, a BGP speaker that issues an open message to initiate a peer-to-peer session uses the AS number that you set with the Local AS parameter.

You can use Site Manager to include a different AS number (overriding the default) or use the AS number you specified in the Local AS parameter.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **Local AS to Advertise to Peer** parameter. Click on **Help** or see the parameter description on page A-15. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Specifying a Maximum Update Size

By default, a BGP speaker sends update messages with a maximum size of 800 bytes.

You can use the BCC or Site Manager to specify a maximum update message size (overriding the default).

Note that if the update message that advertises a single route is larger than the configured message size, the actual message size can exceed the configured value.

### *Using the BCC*

Navigate to a BGP peer-specific prompt and enter:

**max-update-size** <*bytes*>

*bytes* is an integer indicating the maximum size of updates that BGP sends on this peer session.

For example, the following command specifies a maximum size of 950 bytes for updates sent on the peer session established between interfaces 2.2.2.2 and 2.2.2.5:

```
peer/2.2.2.2/2.2.2.5/5# max-update-size 950
peer/2.2.2.2/2.2.2.5/5#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **Peer Max Update Size** parameter. Click on **Help** or see the parameter description on page A-15. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Setting the Route Echo Switch

The peer route echo switch controls the way the router echoes a BGP route that is chosen for forwarding. Echoing in this case means advertising the route back to the peer from which it was received.

By default, the router advertises the route back as reachable and includes the local AS.

You can use the BCC or Site Manager to configure BGP to echo the route as unreachable/withdrawn.

### *Using the BCC*

Navigate to a BGP peer prompt and enter:

**route-echo** <*state*>

*state* is one of the following:

**enabled**
**disabled** (default)

For example, the following command causes BGP to echo a route as unreachable:

```
bgp# route-echo enable
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **Peer Route Echo Switch** parameter. Click on **Help** or see the parameter description on page A-16. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Disabling and Reenabling Loop Detection

By default, BGP terminates a peer-to-peer session if it discovers a loop in the AS path.

You can use the BCC or Site Manager to disable and reenable loop detection.

### *Using the BCC*

Navigate to a BGP peer prompt and enter:

**detect-as-loop** <*state*>

*state* is one of the following:

**enabled** (default)
**disabled**

For example, the following command disables loop detection on peer-to-peer session 2.2.2.2/2.2.2.4:

```
peer/2.2.2.2/2.2.2.4# detect-as-loop disabled
peer/2.2.2.2/2.2.2.4#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **Loop Detection** parameter. Click on **Help** or see the parameter description on page A-17. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Specifying the Route Reflector Mode of the Remote Peer

For complete information about configuring a route reflector or RR client, see “Configuring IBGP as a Route Reflector or an RR Client” on page 8-88.

## Setting the Backoff Timer on an IBGP Route Server

By default, an IBGP route server waits 30 seconds before acquiring an RS client that has initiated a peer-to-peer session. This delay eliminates contention between route servers for clients.

Site Manager allows you to specify a connection delay interval from 1 to 30 seconds.

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **Delayed Granularity** parameter**.** Click on **Help** or see the parameter description on page A-16. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Setting the TTL Counter on an Update

By default, IP uses the IP global time-to-live (TTL) value to set the TTL counter in each BGP update that it sends to a remote BGP peer. Each router that forwards the packet to the next hop decrements the TTL counter by 1. (See "Setting the Time-to-Live Value on a Source Packet" on page 4-11.)

The BCC provides a parameter that allows you to configure a different TTL value for updates sent over a BGP peer-to-peer session.

For an external BGP peer-to-peer session, this parameter is valid only if BGP is configured to allow multihop EBGP sessions. If multihop sessions are not allowed, BGP sets the TTL value to 1 to enforce the one-hop rule. (See "Enabling Multihop Connections" on page 8-21.)

You can use the BCC to perform this function.

To specify a TTL value for updates sent over a BGP peer-to-peer session, navigate to a BGP peer prompt and enter:

**ttl** <*value*>

*value* is one of the values listed in Table 8-7.

**Table 8-7. BGP Time-to-Live Values**

| Value | Meaning |
|---|---|
| 0 (default) | Causes IP to use the IP global TTL value |
| 1 to 255 | Specifies a TTL value that IP uses instead of the IP global TTL value |

For example, the following command sets the TTL parameter to 50:

```
peer/2.2.2.2/2.2.2.4# ttl 50
peer/2.2.2.2/2.2.2.4#
```

# Using the Circuitless IP Interface for a Peer-to-Peer Session

In configuring a peer-to-peer session for BGP speakers, you specify a local peer address (the address of a local IP interface) and a remote peer address (the address of a remote IP interface).

In situations where BGP speakers reside on routers that have multiple network connections over multiple IP interfaces (the typical case for IBGP speakers), consider using the address of the router's circuitless IP interface as the local peer address.

By using the address of the circuitless IP interface as the local peer address in an IBGP configuration, you ensure that BGP is reachable as long as there is an active circuit on the router.

# Configuring Peers over an Unnumbered Point-to-Point Link

You cannot configure a BGP peer-to-peer session directly on an unnumbered interface. To establish a connection, each side of the connection must be associated with a numbered interface.

For example, consider the two routers in Figure 8-4. Routers A and B are connected by a point-to-point network using unnumbered interfaces. Both routers are configured with BGP.

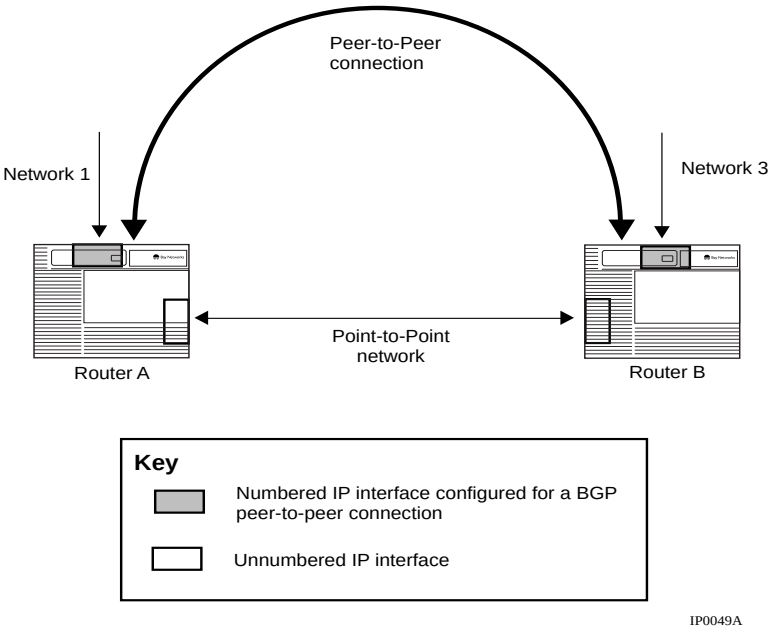


**Figure 8-4. BGP over an Unnumbered Point-to-Point Link**

To establish a peer-to-peer session between router A and router B:

1. **Choose a numbered interface on each router for the peer-to-peer session. Note the network/subnet that each interface is on.**

   In Figure 8-4, router A has a numbered interface to network 1. Router B has a numbered interface to network 3. The network administrator has chosen these two interfaces to support the peer-to-peer session.

2. **If the two routers are in different ASs, enable multihop EBGP connections.**

3. **If no IGP protocol (RIP or OSPF) is running over the unnumbered link, configure a static route on each router to the other router's network and subnet.**

   Because the routers do not share a numbered subnet, each BGP peer needs to know a route to the network/subnet of the interface that the other BGP peer uses. If there is an IGP protocol (RIP or OSPF) running over the unnumbered link, RIP or OSPF will learn the route and store it in the routing table. Otherwise, you need to configure a static route on each router to the other BGP peer's network/subnet. The route should point to the unnumbered link.

4. **Configure the BGP connection on each router.**

## Assigning Weight and Class Values to an AS

You can assign a weight class to any AS number and a weight value to a weight class. Weights provide a way either to prefer or to avoid routes that pass through certain ASs. The weights of each AS in a path are added, and the path with the smallest total weight is the preferred path. An assigned weight can range from 1 to 15 plus an infinity value. Any path containing an AS weight of infinity is avoided.

AS weight classes allow you to assign multiple weight values to the same AS. This feature allows you to consider an AS path differently for different networks. For example, consider a situation in which two networks -- 192.32.1.0 and 192.32.2.0 -- are both reachable by two paths. The first path to each network shares a common AS -- AS 5. The second path to each network also shares a common AS -- AS 10. If you want to favor AS 5 in the path to 192.32.1.0 and AS 10 in the path to 192.32.2.0, you can assign one weight class to the AS in the path to network 192.32.1.0 and another class to the AS in the path to 192.32.2.0.

When a BGP router receives a new route, it evaluates the route against any existing accept policies. If after this evaluation the path still is to be used, the router calculates the total weight of the path. Configure AS weights the same on all BGP routers in an AS.

You can use Site Manager to assign a weight and a weight class to an AS.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Weights**. | The BGP AS Weight Parameters window opens. |
| 5. Click on **Add**. | The BGP AS Weights window opens. |
| 6. Set the following parameters:<br>• **AS**<br>• **Weight Value 1 through 8**<br>Click on **Help** or see the parameter descriptions beginning on page A-18. | |
| 7. Click on **OK**. | Site Manager returns you to the BGP AS Weight Parameters window. |

# Configuring BGP Accept and Announce Policies

BGP accept and announce policies govern which routes a router uses and which routes it propagates to other routers.

**Note:** By default, an external BGP-3 or BGP-4 speaker will neither advertise any routes to a peer, nor inject any routes into its IGP. Route policies must be configured to enable any route advertisement.

So that every BGP border router within an AS comes to the same decision in constructing path attributes for an external path, routing policies must be coordinated among all BGP speakers within an AS. Bay Networks recommends that the accept and announce policies on all IBGP connections accept and propagate all routes. On external BGP connections, you must make consistent routing policy decisions.

**Note:** In addition to announce and accept policies, Bay Networks supports import and export filters for BGP-3. Import and export filters provide a subset of the parameters provided by the policies.

When a BGP speaker receives a route in an update message, it applies any local routing policies to determine whether the router will use the route and whether it will propagate the route to other routers. Then, if the route can be used, it is compared against routes from other protocols and possibly included in the forwarding table.

This section covers the following topics:


| Topic | Page |
|---|---|
| Defining a BGP Accept Policy | 8-64 |
| Supplying Modification Values for a BGP Accept Policy | 8-67 |
| Specifying Matching Criteria for a BGP Accept Policy | 8-70 |
| Defining a BGP Announce Policy | 8-73 |
| Supplying Modification Values for a BGP Announce Policy | 8-76 |
| Specifying Matching Criteria for a BGP Announce Policy | 8-80 |

## Defining a BGP Accept Policy

BGP-4 accept policies govern which routes BGP submits to the IP routing table manager. When BGP encounters an update that matches the policy, it performs the action you specify.

To define a new BGP accept policy, you must do the following:

- Supply a name for the accept policy.
- Set the state of the policy (enabled or disabled).
- Specify whether BGP ignores or accepts an update that matches the policy.
- Rank the policy according to preference, precedence, and BGP weight class.

You can use the BCC or Site Manager to define a BGP accept policy.

### *Using the BCC*

Navigate to the BGP global prompt and enter:

**accept** *<policy_name>*

*policy_name* is a unique name for the BGP accept policy.

A policy-specific prompt appears, indicating that the BCC has created the policy using default values for all parameters.

For example, the following command creates an accept policy named accept_pol_1:

```
bgp# accept accept_pol_1
accept/accept_pol_1/bgp#
```

In response to the prompt, enter:

*<parameter> <value>*

*parameter value* is one of the parameter/value pairs described in Table 8-8.

**Table 8-8. BCC Definition Parameters for BGP Accept Policies**

| Parameter | Values | Function |
|---|---|---|
| state | Enabled (default)<br>Disabled | Enables and disables the policy you have created |
| action | Ignore (default)<br>Accept | Specifies whether the protocol ignores a route that matches the policy or forwards the route to the routing table manager |
| preference | 1 (default) to 16 | Assigns a metric value (the higher the number, the greater the preference) to a route that the protocol forwards to the routing table manager. If confronted with multiple routes to the same destination, the routing table manager may need to use this value to decide which route to insert. Routes for all networks (0.0.0.0/ 0.0.0.0) should have the lowest preference and routes for the most specific networks (longest address and mask) should have the highest preference. |
| precedence | 0 (default) to any integer | Assigns a metric value to this policy (a policy with a higher value takes precedence over a policy with a lower value). This value determines the order of precedence for policies that match the same route. |
| bgp4-preference | 1 (default) to 16 | Specifies a value that can be used to compare a route that matches this policy with other BGP-4 routes. The larger the value, the greater the preference. |
| as-weight-class | Class 1 to class 8 | Indicates which weight class value should be used when calculating the AS path weight |
| route-damping | Enabled<br>Disabled (default) | Configures BGP to perform route flap dampening on a route that matches this policy |
| route-damping-template | Default or a unique template name | Configures BGP to use the default route flap dampening template or the template you specify |

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Policy Filters**. | The Policy Filters menu opens. |
| 4. Choose **BGP-4**. | The BGP-4 menu opens. |
| 5. Choose **Accept Policies**. | The BGP4 Accept Policy Filters window opens. |
| 6. Click on **Add**. | The BGP4 Accept IP Policy Filter Configuration window opens. |
| 7. Set the following parameters:<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Route Preference**<br>• **Rule Precedence**<br>• **BGP-4 Preference**<br>• **AS Weight Class**<br>Click on **Help** or see the parameter descriptions beginning on pages B-2 and B-19. | |
| 8. Click on **OK**. | Site Manager returns you to the BGP4 Accept Policy Filters window. |

## Supplying Modification Values for a BGP Accept Policy

You can use the BCC or Site Manager to supply values that BGP can use to modify an attribute in a BGP update that matches the policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**modify**

A modification prompt appears for the policy. For example:

```
accept/pol_1/bgp# modify
modify/bgp/accept/pol_1#
```

To modify an attribute, enter:

*<attribute> <value>*

*attribute value* is one of the attribute/value combinations described in Table 8-9.

**Table 8-9. BCC Modification Attributes for BGP Accept Policies**

| Attribute | Values | Function |
|---|---|---|
| local-preference | 0 (default) to 4,294,967,295 | Specifies an override value for the local preference attribute |
| med-method | Passthru (default)<br>Override<br>Generate<br>Delete | Indicates whether or not a multiexit discriminator metric is to be used for a network matching this policy and what value to use |
| med | -1 or an integer | Specifies a metric for the multiexit discriminator attribute |
| as-path-prepend | List of AS numbers | Specifies AS numbers that BGP adds to an AS path before it adds the current AS to the path |
| inject* | List of IP addresses | Specifies a list of networks that BGP advertises instead of the networks in the routing table |

* The BCC treats this attribute as an object. When you press Enter, the BCC creates the object and displays an object-specific prompt. To specify multiple attributes, create multiple objects.

For example, the following command specifies override as the method for accept policy pol_1:

```
set/bgp/accept/pol_1# med-method override
set/bgp/accept/pol_1#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Policy Filters**. | The Policy Filters menu opens. |
| 4. Choose **BGP-4**. | The BGP-4 menu opens. |
| 5. Choose **Accept Policies**. | The BGP4 Accept Policy Filters window opens. |
| 6. Click on the policy that you want to modify. | |
| 7. Edit one or more of the parameters for that policy. Click on **Help** or see the parameter descriptions beginning on pages B-2 and B-16. | |
| 8. Click on **Done**. | You return to the Configuration Manager window. |

## Specifying Matching Criteria for a BGP Accept Policy

You can use the BCC or Site Manager to specify a match for a policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**match**

A match prompt appears for the policy.

For example:

```
accept/pol_1/bgp# match
match/bgp/accept/pol_1#
```

To supply matching criteria for an accept policy, enter:

*<match_parameter> <value>*

*match_parameter value* is one of the parameter/value pairs described in Table 8-10.

**Table 8-10. BCC Matching Parameters for BGP Accept Policies**

| Parameter | Values | Function |
|---|---|---|
| as-path-pattern | Null or an AS path | Specifies an AS path that overrides the AS-path attribute of a route matching this policy |
| origin | Any (default)<br>IGP<br>EGP<br>IGP or EGP<br>Incomplete<br>Incomplete or IGP<br>Incomplete or EGP | Specifies the values of the BGP origin path attribute that apply to this policy |
| aggregator-as* | AS number | Specifies an autonomous system. This policy applies to BGP advertisements that contain in their aggregator path attribute this AS number. |

*(continued)*

**Table 8-10. BCC Matching Parameters for BGP Accept Policies** *(continued)*

| Parameter | Values | Function |
|---|---|---|
| aggregator-router* | IP address | Specifies a BGP router. This policy applies to BGP advertisements that contain in their Aggregator path attribute this IP address. |
| as* | AS number | Specifies an AS. This policy applies to BGP advertisements from the peer in this AS. |
| community* | BGP community | Specifies a BGP community. This policy applies to all BGP advertisements that match the community. |
| network* | IP address | Specifies a network ID to be included in the routing table in place of the network ID in the received advertisement. |
| originating-as* | AS number | Specifies an autonomous system. This policy applies to BGP advertisements that originate from this AS. |
| peer* | IP address | Specifies a BGP peer. This policy applies to BGP advertisements from this peer. |

* The BCC treats this matching criterion as an object. When you press Enter, the BCC creates an object and displays an object-specific prompt. To specify multiple criteria, create multiple objects.

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Policy Filters**. | The Policy Filters menu opens. |
| 4. Choose **BGP-4**. | The BGP-4 menu opens. |
| 5. Choose **Accept Policies**. | The BGP4 Accept Policy Filters window opens. |
| 6. Click on **Add**. | The BGP4 Accept IP Policy Filter Configuration window opens. |
| 7. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Route Preference**<br>• **Rule Precedence**<br>• **Injection List**<br>• **Peer AS**<br>• **Peer Address**<br>• **Local Preference**<br>• **BGP-4 Preference**<br>• **AS Weight Class**<br>• **AS Pattern**<br>• **Community Match**<br>Click on **Help** or see the parameter descriptions beginning on pages B-2 and B-16. | |
| 8. Click on **OK**. | Site Manager returns you to the BGP4 Accept Policy Filters window. |

## Defining a BGP Announce Policy

BGP announce policies govern which routes BGP propagates to other routers. When BGP encounters an update that matches the policy, it performs the action you specify.

To define a BGP announce policy, you must do the following:

- Supply a name for the new announce policy.
- Specify whether BGP ignores or advertises an update that matches the policy.
- Rank policies according to precedence.

You can use the BCC or Site Manager to configure a BGP announce policy.

### *Using the BCC*

Navigate to the BGP global prompt and enter:

**announce** <*policy_name*>

*policy_name* is a unique name for the BGP announce policy.

A policy-specific prompt appears, indicating that the BCC has created the policy using default values for all parameters.

For example, the following command creates an announce policy named pol_1:

```
bgp# announce pol_1
announce/pol_1/bgp#
```

In response to the prompt, enter:

*<parameter>* <*value*>

*parameter value* is one of the parameter/value pairs shown in Table 8-11.

**Table 8-11. BCC Definition Parameters for BGP Announce Policies**

| Parameter | Values | Function |
|---|---|---|
| state | Enabled (default)<br>Disabled | Enables or disables this policy |
| action | Ignore (default)<br>Propagate | Specifies whether or not to advertise a route that matches this policy |
| precedence | 0 (default) to any metric value | Specifies a metric value to be used to compare this policy with other policies that a route may match. A policy with a higher metric takes precedence over a policy with a lower metric. In case of a tie, the protocol uses an internal index value assigned to the policy by IP software. (In general, the index value is indicated by the position of the policy in the Site Manager display -- the last policy in the display has the highest index value.) |

## *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Policy Filters**. | The Policy Filters menu opens. |
| 4. Choose **BGP-4**. | The BGP-4 menu opens. |
| 5. Choose **Announce Policies**. | The BGP4 Announce Policy Filters window opens. |
| 6. Click on **Add**. | The BGP4 Announce IP Policy Filter Configuration window opens. |

*(continued)*

| **Site Manager Procedure** *(continued)* | |
|---|---|
| **You do this** | **System responds** |
| 7. Set the following parameters:<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Rule Precedence**<br>• **Route Source**<br>• **Advertise**<br>• **From RIP Gateway**<br>• **Received on RIP Interface**<br>• **From OSPF Router ID**<br>• **Received OSPF Type**<br>• **Received OSPF Tag**<br>• **From EGP Peer**<br>• **From EGP AS**<br>• **From EGP Gateway**<br>• **From BGP Peer**<br>• **From BGP AS**<br>• **Received BGP Next Hop**<br>• **External Route Source**<br>• **Outbound Peer AS**<br>• **Outbound Peers**<br>• **Multi-Exit Discriminator**<br>• **Multi-Exit Discriminator Value**<br>• **Origin**<br>• **AS Path**<br>• **Local Preference Override**<br>• **Local Preference Value**<br>• **Next Hop**<br>• **Atomic**<br>• **AS Pattern**<br>• **Community Match**<br>Click on **Help** or see the parameter descriptions beginning on pages B-25 and B-52. | |
| 8. Click on **OK**. | Site Manager returns you to the BGP4 Announce Policy Filters window. |

## Supplying Modification Values for a BGP Announce Policy

You can use the BCC or Site Manager to supply values that BGP uses to modify fields in a BGP update that matches the policy.

### *Using Site Manager*

Navigate to the policy-specific prompt and enter:

**modify**

For example, the following command invokes a modification prompt for BGP announce policy pol_1:

```
announce/pol_1/bgp# modify
modify/bgp/announce/pol_1#
```

To supply a value, enter:

*<attribute> <value>*

*attribute value* is one of the combinations shown in Table 8-12.

**Table 8-12. BCC Override Attributes for BGP Announce Policies**

| Attribute | Values | Function |
|---|---|---|
| as-path | Null (default) or an AS path | Specifies an AS path that overrides the AS-path attribute of a route matching this policy. An AS path is composed of AS path segments. Each path segment includes a path segment type, a path segment length specifying the number of ASs in the segment, and a path segment value containing one or more AS numbers. There are two AS path segment types: type 1, an unordered set of ASs that a route in the update message has traversed; and type 2, an ordered set of ASs that a route in the update message has traversed. |
| as-path-prepend | List of AS numbers | Specifies AS numbers that BGP adds to an AS path before it adds the current AS to the path. |

*(continued)*

**Table 8-12. BCC Override Attributes for BGP Announce Policies** *(continued)*

| Attribute | Values | Function |
|---|---|---|
| atomic aggregate | Automatic (default)<br>Force<br>Ignore | Allows control over the atomic path attribute. By default, the router automatically sets this attribute if it knows that certain networks in aggregate range have not been included in an aggregate advertisement. |
| local-preference | False (default)<br>True | Indicates whether or not you are supplying an override value for the Local Preference path attribute in the routing update message. (The local pref attribute is valid only in an update advertised to an IBGP peer.) If you select False, the router uses the IP route weight value to calculate the local_pref path attribute. |
| local-pref-override | Null (default) or a route weight value | Specifies an override value for the local preference attribute |
| med-method | None (default)<br>Specified<br>Originating | Indicates whether or not a multiexit discriminator metric is to be advertised for a network matching this policy and, if advertised, what value to use. Select None to indicate that no value is to be advertised. Select Specified to indicate that the value you specify for the Multi-Exit Discriminator Value parameter is to be used. Select Originating to indicate that the metric from the originating protocol is to be used. This parameter is valid only if the Action parameter is set to Propagate. |
| med | Null (default) or a metric value | Specifies a metric for the multiexit discriminator attribute |
| next-hop | Null (default) or an IP address | Overrides the next-hop path attribute with the IP address you specify |
| origin | As Is (default)<br>IGP<br>EGP<br>Incomplete | Specifies an origin attribute override. The Origin attribute of a route matching this policy will be replaced with the indicated value. |
| community-method | as-is (default), remove, append, replace | Specifies the action to take on the BGP communities attribute in updates matching this policy |

*(continued)*

**Table 8-12. BCC Override Attributes for BGP Announce Policies** *(continued)*

| Attribute | Values | Function |
|---|---|---|
| advertise* | List of IP addresses | Specifies a list of networks that BGP advertises instead of the networks in the routing table |
| community* | List of communities | Specifies a list of communities that BGP advertises |

* The BCC treats this attribute as a BCC object. When you press Enter, the BCC creates the object and displays an object-specific prompt. To specify multiple attributes, create multiple objects.

## *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Policy Filters**. | The Policy Filters menu opens. |
| 4. Choose **BGP-4**. | The BGP-4 menu opens. |
| 5. Choose **Announce Policies**. | The BGP4 Announce Policy Filters window opens. |
| 6. Click on **Add**. | The BGP4 Announce IP Policy Filter Configuration window opens. |

*(continued)*

| **Site Manager Procedure** *(continued)* | |
|---|---|
| **You do this** | **System responds** |
| 7. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Rule Precedence**<br>• **Route Source**<br>• **Advertise**<br>• **From RIP Gateway**<br>• **Received on RIP Interface**<br>• **From OSPF Router ID**<br>• **Received OSPF Type**<br>• **Received OSPF Tag**<br>• **From EGP Peer**<br>• **From EGP AS**<br>• **From EGP Gateway**<br>• **From BGP Peer**<br>• **From BGP AS**<br>• **Received BGP Next Hop**<br>• **External Route Source**<br>• **Outbound Peer AS**<br>• **Outbound Peers**<br>• **Multi-Exit Discriminator**<br>• **Multi-Exit Discriminator Value**<br>• **Origin**<br>• **AS Path**<br>• **Local Preference Override**<br>• **Local Preference Value**<br>• **Next Hop**<br>• **Atomic**<br>• **AS Pattern**<br>• **Community Match**<br>Click on **Help** or see the parameter descriptions beginning on pages B-25 and B-52. | |
| 8. Click on **OK**. | Site Manager returns you to the BGP4 Announce Policy Filters window. |

## Specifying Matching Criteria for a BGP Announce Policy

You can use the BCC or Site Manager to specify matching criteria for a BGP announce policy.

### *Using the BCC*

Navigate to the policy-specific prompt and enter:

**match**

For example, the following command invokes a match prompt for BGP announce policy pol_1:

```
announce/pol_1/bgp# match
match/bgp/announce/pol_1#
```

To specify a match, enter:

*<match_criterion> <value>*

*match_criterion value* is one of the criterion/value pairs shown in Table 8-13.

**Table 8-13. BCC Match Criterion for BGP Announce Policies**

| Criterion | Values | Function |
|---|---|---|
| as-path-pattern | Empty string or any regular expression | Allows as_path pattern matching. Enter a valid regular expression to indicate an AS and its position in a path. The policy applies to all routes whose AS path includes the AS in that position. For example, the expression * 200 $ means that the policy applies to all routes whose as_path attribute contains AS 200 as the last AS in the path. |
| external-source | Any (default)<br>Direct<br>Static<br>RIP<br>OSPF with type 2 metric<br>EGP<br>BGP | Specifies one or more external route source identifiers. If you specify an external route source, a route from that source that meets the other criteria of this policy matches the policy. This parameter applies only to OSPF routes that use the new ASE type 2 metric. The protocol from which OSPF received the route is encoded in the ASE metric, along with the route's metric. To specify any external route source, use the default. |
| ospf-type | Any (default)<br>Type 1<br>Type 2<br>External<br>Internal | Specifies which types of OSPF routes match this policy, and applies only to OSPF-sourced routes and if OSPF is included as a route source |
| protocol-source | Any (default)<br>Direct<br>Static<br>RIP<br>OSPF<br>EGP<br>BGP | Specifies one or more route source identifiers. If you select a route source ID, a route from that source that meets the other criteria of this policy matches the policy. |
| bgp-as* | List of AS numbers | Specifies a list of autonomous system numbers. This policy applies to BGP advertisements received from BGP peers in this AS, and applies only to BGP-sourced routes and if BGP is included as a route source. |

*(continued)*

**Table 8-13. BCC Match Criterion for BGP Announce Policies** *(continued)*

| Criterion | Values | Function |
|---|---|---|
| bgp-next-hop* | List of IP addresses | Specifies one or more IP addresses. This policy applies to BGP advertisements whose Next Hop attribute matches an IP address on this list, and applies only to BGP-sourced routes and if BGP is included as a route source. |
| bgp-peer* | List of IP addresses | Specifies the IP address of one or more BGP peers. This policy applies to BGP advertisements authored by a router on this list, and applies only to BGP-sourced routes and if BGP is included as a route source. |
| egp-as* | List of AS numbers | Specifies one or more autonomous system numbers. This policy applies to EGP advertisements received from EGP peers in an AS on this list and applies only to EGP-sourced routes and if EGP is included as a route source. |
| egp-gateway* | List of IP addresses | Specifies the IP address of one or more EGP gateways. This policy applies to EGP advertisements that use a gateway on this list as the next hop, and applies only to EGP-sourced routes and if EGP is included as a route source. |
| egp-peer* | List of IP addresses | Specifies the IP address of one or more EGP peers. This policy applies to EGP advertisements authored by a router on this list, and applies only to EGP source routes and if EGP is included as a route source. |
| inbound-interface* | List of IP addresses | Specifies the address of one or more interfaces on this router. This policy applies to RIP advertisements received on the interfaces in this list, and applies only to RIP-sourced routes and if RIP is included as a route source. |

*(continued)*

**Table 8-13. BCC Match Criterion for BGP Announce Policies** *(continued)*

| Criterion | Values | Function |
|---|---|---|
| network* | List of IP addresses | Specifies which networks will match this policy. Each identifier consists of a network number, a mask, and a flag to indicate whether the ID refers to a specific network or a range of networks. Enter a specific encoding of 0.0.0.0/0.0.0.0 to match the default route. Enter a range encoding of 0.0.0.0/0.0.0.0 to match any route. Enter an empty list to match any route. |
| ospf-router-id* | List of IP addresses | Specifies the IDs of one or more OSPF routers. This policy applies to OSPF advertisements authored by a router on this list, and applies only to OSPF-sourced routes and if OSPF is included as a route source. |
| ospf-tag* | List of OSPF ASE tag values | Specifies tag values that could be present in an OSPF ASE advertisement. This policy applies to OSPF ASE advertisements that contain tag values in this list, and applies only to OSPF-sourced ASE routes and if OSPF is included as a route source. |
| outbound-interface* | List of IP addresses | Specifies a list of outbound RIP interfaces. If an interface appears in this list, the policy applies to RIP advertisements sent via that interface. |
| rip-gateway* | List of IP addresses | Specifies the addresses of one or more routers that could send RIP updates to this router. This policy applies to RIP advertisements from routers on this list, and applies only to RIP-sourced routes and if RIP is included as a route source. |

* The BCC implements this matching criterion as an object. To specify multiple items, create multiple objects.

### *Using Site Manager*

You can use Site Manager to configure a BGP-4 announce policy.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Policy Filters**. | The Policy Filters menu opens. |
| 4. Choose **BGP-4**. | The BGP-4 menu opens. |
| 5. Choose **Announce Policies**. | The BGP4 Announce Policy Filters window opens. |
| 6. Click on the policy that you want to edit. | |

*(continued)*

| **Site Manager Procedure** *(continued)* | |
|---|---|
| **You do this** | **System responds** |
| 7. Set the following parameters:<br>• **Enable**<br>• **Name**<br>• **Networks**<br>• **Action**<br>• **Rule Precedence**<br>• **Route Source**<br>• **Advertise**<br>• **From RIP Gateway**<br>• **Received on RIP Interface**<br>• **From OSPF Router ID**<br>• **Received OSPF Type**<br>• **Received OSPF Tag**<br>• **From EGP Peer**<br>• **From EGP AS**<br>• **From EGP Gateway**<br>• **From BGP Peer**<br>• **From BGP AS**<br>• **Received BGP Next Hop**<br>• **External Route Source**<br>• **Outbound Peer AS**<br>• **Outbound Peers**<br>• **Multi-Exit Discriminator**<br>• **Multi-Exit Discriminator Value**<br>• **Origin**<br>• **AS Path**<br>• **Local Preference Override**<br>• **Local Preference Value**<br>• **Next Hop**<br>• **Atomic**<br>• **AS Pattern**<br>• **Community Match**<br>Click on **Help** or see the parameter descriptions beginning on pages B-25 and B-52. | |
| 8. Click on **Done**. | You return to the Configuration Manager window. |

## Configuring BGP-4 AS Pattern-Matching

Table 8-14 describes the special characters used in the Bay Networks implementation of AS pattern-matching.

**Table 8-14. Characters in AS Path Pattern-Matching**

| Symbol or Operator | Meaning |
|---|---|
| < | Denotes the beginning of an AS SEQUENCE segment |
| > | Denotes the end of an AS SEQUENCE segment |
| { | Denotes the beginning of an AS SET segment |
| } | Denotes the end of an AS SET segment |
| <*seq*>{*set*} | Denotes an AS path containing a sequence in the first segment and a set in the second segment |
| ^ | Denotes the following pattern occurs at the beginning of the AS path |
| $ | Denotes the preceding pattern occurs at the end of the AS path |
| \| | Denotes logical OR - match this or that |
| _*X*_ | Matches exactly the AS specified by *X* |
| _*X* | Matches the AS pattern beginning with *X* (for example, "_99" matches 99, 991, 9934) |
| *X*_ | Matches the AS pattern ending with *X* (for example, "99_" matches 99,199, 23299) |

# Configuring BGP Message Logging

Site Manager allows you to control the event messages that BGP sends to the log file by specifying:

- Local and remote addresses of a peer-to-peer session or sessions
- Message severity level: fault, warning, information, trace, debug, or all levels
- BGP message type: open, update, notification, or keepalive

Use BGP message logging parameters to limit the volume of debug-level messages that BGP generates and logs. If you allow BGP to log all debug-level events, the messages that BGP generates will quickly overrun and overwrite the log file.

You can use Site Manager to control BGP event messages.

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Debug**. | The Edit BGP Debug Parameters window opens. |
| 5. Set the following parameters:<br>• **Local IP Address**<br>• **Remote Address**<br>• **Message Level**<br>• **Message Trace Switch**<br>Click on **Help** or see the parameter descriptions beginning on page A-15. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

# Configuring IBGP as a Route Reflector or an RR Client

To avoid the high cost of a full-mesh topology to support IBGP speakers within a large AS, you can configure a router to function as an *IBGP route reflector.* An IBGP speaker that needs to communicate with other BGP speakers in the AS establishes a peer-to-peer *RR client* session with the IBGP route reflector.

You configure an IBGP speaker to be a route reflector or RR client and establish peer-to-peer connections between reflectors and clients as described under the following topics:


| Topic | Page |
|---|---|
| Configuring a Single Route Reflector in an AS | 8-88 |
| Configuring a Route Reflector Cluster | 8-92 |
| Configuring Multiple RR Clusters in an AS | 8-94 |
| Configuring an RR Client | 8-98 |

**Note:** When you configure a session between two IBGP route reflectors or an RR and an RR client, you must configure both ends of the session. Otherwise, events may occur that cause BGP to shut down the session.

## Configuring a Single Route Reflector in an AS

An IBGP route reflector (RR) is an IBGP speaker that has established a peer-to-peer session with an IBGP speaker defined as an RR client.

A route reflector:

- Receives route advertisements from RR clients (and other reflectors)
- Forwards best-route advertisements to RR clients (and other reflectors)

Figure 8-5, for example, shows an AS with a single route reflector connected to five IBGP speakers configured as RR clients. The RR receives a route advertisement from RR client 1, determines that the route is the best route to the external destination, and forwards the route to RR clients 2, 3, 4, and 5.

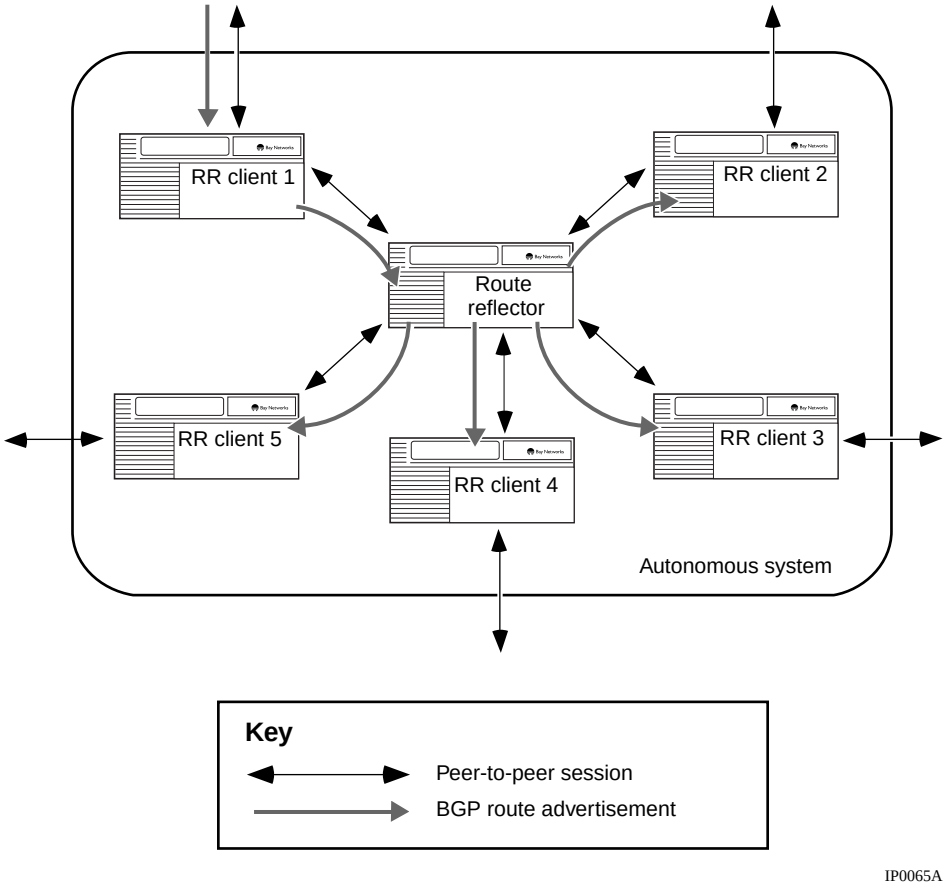


**Figure 8-5. IBGP Single Route Reflector Topology**

You configure an IBGP speaker as a route reflector by establishing a peer-to-peer session with an RR client. You can do this with the BCC or Site Manager.

### *Using the BCC*

Navigate to the global BGP prompt and enter:

**peer local** *<reflector_address>* **remote** *<client_address>* **as** *<as_number>*

*reflector_address* is the IP address of the local route reflector.

*client_address* is the IP address of the remote RR client.

*as_number* is an integer identifying the AS in which the remote client is located. (Because the reflector and the client are located in the same AS, BGP recognizes that this is an IBGP session.)

For complete information, see “Establishing a Peer-to-Peer Session” on page 8-34.

When the session-specific prompt appears, enter the following command to specify that the remote client is an internal peer (that is, located in the same cluster):

**peer-mode reflector-internal**

For example, the following command sequence defines a peer-to-peer session between the route reflector (represented by IP address 2.2.2.2) and an RR client (represented by IP address 2.2.2.3):

```
ip# bgp
bgp# peer local 2.2.2.2 remote 2.2.2.3 as 2
peer/2.2.2.2/2.2.2.3# peer-mode reflector-internal
peer/2.2.2.2/2.2.2.3#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on **Add**. | The BGP Peer Parameters window opens. |
| 8. Set the following parameters:<br>• **Peer Address**<br>• **Peer AS**<br>• **Local Address**<br>• **Peer RS Mode**<br>Click on **Help** or see the parameter descriptions beginning on page A-10. | |
| 9. Click on **OK**. | Site Manager returns you to the BGP Peer List window. |
| 10. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Configuring a Route Reflector Cluster

You can connect multiple route reflectors in a *route reflector cluster*. Within a cluster, IBGP route reflectors must be connected in a full-mesh topology.

To configure a route reflector in a cluster, you establish a peer-to-peer session with one or more reflectors in the same cluster. You can do this with the BCC or Site Manager.

### *Using the BCC*

To establish a peer-to-peer session with another route reflector in the same cluster, navigate to the global BGP prompt and enter:

**peer local** *<local_reflector_address>* **remote** *<remote_reflector_address>* **as** *<as_number>*

*local_reflector_address* is the IP address of an interface on the local route reflector.

*remote_reflector_address* is the IP address of an interface on the remote route reflector.

*as_number* is an integer identifying the AS in which remote reflector is located. (Because the reflector and the client are located in the same AS, BGP recognizes that this is an IBGP session.)

When the session-specific prompt appears, enter the following command to specify that the remote route reflector is an internal peer (that is, located in the same cluster):

**peer-mode reflector-internal**

For example, the following command sequence defines a peer-to-peer session between two route reflectors (represented by addresses 2.2.2.2 and 2.2.2.3) located in the same cluster in AS 2:

```
bgp# peer local 2.2.2.2 remote 2.2.2.3 as 2
peer/2.2.2.2/2.2.2.3# peer-mode server-internal
peer/2.2.2.2/2.2.2.3#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on **Add**. | The BGP Peer Parameters window opens. |
| 8. Set the following parameters:<br>• **Peer Address**<br>• **Peer AS**<br>• **Local Address**<br>• **Peer Mode**<br>Click on **Help** or see the parameter descriptions beginning on page A-10. | |
| 9. Click on **OK**. | Site Manager returns you to the BGP Peer List window. |
| 10. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

## Configuring Multiple RR Clusters in an AS

An AS can contain multiple IBGP route reflector clusters. In an AS with multiple clusters:

- Each cluster has a unique ID.
- Within each cluster, RR clients are connected to RRs in a tree topology.
- Within the AS, clusters are connected in arbitrary topologies. (From the point of view of the topology, a cluster is a mini-AS. Like an AS, a cluster can be configured in an arbitrary way.)

You can use the BCC or Site Manager to perform the following operations:

- Associate a route reflector with a cluster.
- Establish a peer-to-peer session with a server in another cluster.

### *Using the BCC*

To associate a route reflector with a cluster, navigate to the BGP global prompt and enter:

**cluster-id** *<cluster_id>*

*cluster_id* is the ID number of the cluster in which the route reflector is located.

For example, the following command associates the route reflector with cluster 5:

```
bgp# cluster-id 5
bgp#
```

To establish a peer-to-peer session with a route reflector in another cluster, navigate to the BGP global prompt and enter:

**peer local** *<local_reflector_address>* **remote** *<remote_reflector_address>* **as** *<as_number>*

*local_reflector_address* is the IP address of an interface on the local route reflector.

*remote_reflector_address* is the IP address of an interface on the remote reflector in another cluster.

*as_number* is an integer identifying the AS in which the remote server is located.

When the session-specific prompt appears, enter the following command to specify that the remote peer is a route reflector in another cluster:

**peer-mode reflector-external**

For example, the following command sequence defines a peer-to-peer session between two route reflectors (represented by addresses 2.2.2.2 and 2.2.2.3) located in different clusters in AS 2:

```
ip# bgp
bgp# peer local 2.2.2.2 remote 2.2.2.3 as 2
peer/2.2.2.2/2.2.2.3# peer-mode reflector-external
peer/2.2.2.2/2.2.2.3#
```

### *Using Site Manager*

Use the following procedure to establish a peer-to-peer session with a route reflector in another cluster:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on **Add**. | The BGP Peer Parameters window opens. |
| 8. Set the following parameters:<br>• **Peer Address**<br>• **Peer AS**<br>• **Local Address**<br>• **Peer Mode**<br>Click on **Help** or see the parameter descriptions beginning on page A-10. | |
| 9. Click on **OK**. | Site Manager returns you to the BGP Peer List window. |
| 10. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

To associate a route reflector with a cluster, use the following procedure:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **Cluster Identifier p**arameter. Click on **Help** or see the parameter description on page A-8. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring an RR Client

An RR client is a BGP/IBGP speaker with a peer-to-peer session with a route reflector and one or more peer-to-peer sessions with external BGP speakers.

You can use the BCC or Site Manager to establish a peer-to-peer session with one or more route reflectors in the same cluster.

### *Using the BCC*

Navigate to the global BGP prompt and enter:

**peer local** *<client_address>* **remote** *<reflector_address>* **as** *<as_number>*

*client_address* is the IP address of an interface on the local client.

*reflector_address* is the IP address of an interface on the remote reflector.

*as_number* is an integer identifying the AS in which the client and the server are located.

When the session-specific prompt appears, enter the following command:

**peer-mode none**

For example, the following command sequence defines a peer-to-peer session between an RR client and RR (represented by addresses 2.2.2.2 and 2.2.2.3):

```
ip# bgp
bgp# peer local 2.2.2.2 remote 2.2.2.3 as 2
peer/2.2.2.2/2.2.2.3# peer-mode none
peer/2.2.2.2/2.2.2.3#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on **Add**. | The BGP Peer Parameters window opens. |
| 8. Set the following parameters:<br>• **Peer Address**<br>• **Peer AS**<br>• **Local Address**<br>• **Peer Mode**<br>Click on **Help** or see the parameter descriptions beginning on page A-10. | |
| 9. Click on **OK**. | Site Manager returns you to the BGP Peer List window. |
| 10. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

# Configuring IBGP for Route and Traffic-Load Balancing

IBGP route balancing and traffic-load balancing are two techniques that allow an IBGP speaker to distribute routes to the same destination among multiple equal-cost paths.

In both techniques, IBGP uses equal cost multipath (ECMP) routes submitted to the IP routing table by the IGP (OSPF or RIP) in the AS. The ECMP routes could also be static routes. For information about ECMP routing, see Chapter 4.

To configure an IBGP speaker for route balancing and traffic-load balancing, the IGP used in the AS (OSPF, for example) must be configured for ECMP on all routers.

Figure 8-6, for example, shows an AS containing six IP routers. The routers with interfaces to internal links are running OSPF. The routers with interfaces to both internal and external links are running OSPF and BGP.

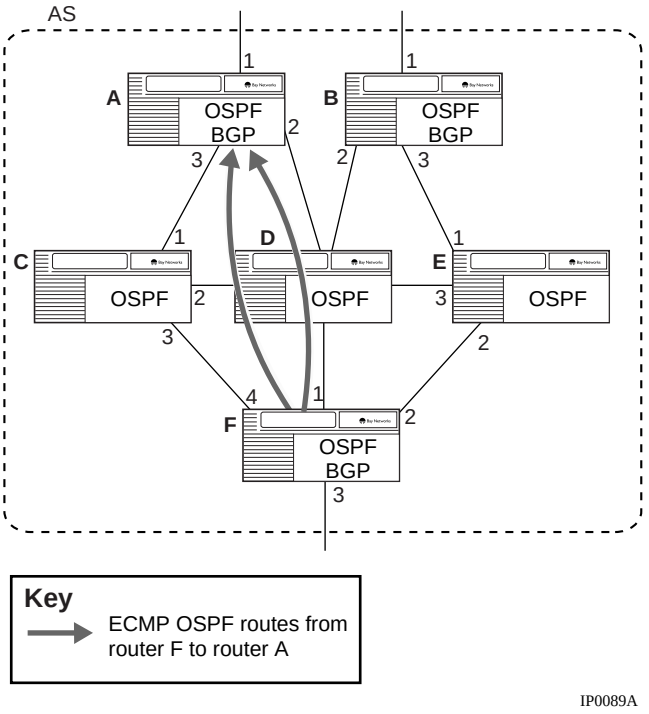


**Figure 8-6. BGP/OSPF Autonomous System**

Assume for this example that OSPF is configured throughout the AS to support ECMP routes and that all links in the AS have the same cost. This means that the IP routing table in router F includes two ECMP routes to router A. One route uses interface 1; the other route uses interface 4.

Assume as well that the BGP speakers on routers A, B, and F have established a full mesh of IBGP peer-to-peer sessions with each other, using routers C, D, and E.

Now consider that BGP on router F receives advertisements to three destinations (destination_1, destination_2, and destination_3) from its peer on router A. For each of these destinations, BGP must consult the IP routing table to determine the next OSPF hop.

If you configure BGP on router F for IBGP ECMP *route balancing*, BGP submits one BGP route to the routing table for each BGP destination, using in round-robin fashion the available OSPF ECMP routes, as follows:

1. BGP submits a route to destination_1 and specifies interface 1 (the interface to router D) as the next hop.
2. BGP submits a route to destination_2 and specifies interface 4 (the interface to router C) as the next hop.
3. BGP submits a BGP route to destination_3 and specifies interface 1 as the next hop.

Figure 8-7 shows the three route-balancing BGP ECMP entries to the routing table on router 4.

```
Destination/Mask   Proto    Age       Cost      Next Hop       AS
.....................................................................

destination_1        BGP-4   577438   126992  F-1                764
destination_2        BGP-4   577438   126992  F-4                764
destination_3        BGP-4   577438   126992  F-1                764
```

**Figure 8-7. IBGP ECMP Route Balancing**

If you configure BGP for *traffic balancing*, BGP submits multiple BGP routes, one for each OSPF ECMP route, in the following manner:

1. BGP submits two IP routes to destination_1. One route specifies interface 1; the second route specifies interface 4.
2. BGP submits two IP routes to destination_2. One route specifies interface 1; the second route specifies interface 4.
3. BGP submits two IP routes to destination_3. One route specifies interface 1; the second route specifies interface 4.

Figure 8-8 shows the six traffic-balancing BGP ECMP entries to the routing table on router 4.

```
Destination/Mask   Proto    Age       Cost     Next Hop       AS
.....................................................................

destination_1        BGP-4   577438   126992  F-1               764
destination_1        BGP-4   577438   126992  F-4               764
destination_2        BGP-4   577438   126992  F-1               764
destination_2        BGP-4   577438   126992  F-4               764
destination_3        BGP-4   577438   126992  F-1               764
destination_3        BGP-4   577438   126992  F-4               764
```

**Figure 8-8. IBGP ECMP Traffic-Load Balancing**

You can use the BCC or Site Manager to configure IBGP for ECMP route balancing and traffic-load balancing.

### *Using the BCC*

Navigate to the BGP global prompt and enter:

**ibgp-ecmp-method** *<method>*

*method* is one of the values described in Table 8-15.

**Table 8-15. IBGP ECMP Methods**

| Method | Meaning |
|---|---|
| route-balance | BGP submits one BGP route to the IP routing table for each BGP destination, using in turn (round-robin) the available IGP ECMP routes to the next hop. |
| traffic-balance | BGP submits multiple routes to IP, using all known IGP ECMP IP next hops. |

For example, the following command configures BGP for IBGP ECMP traffic-load balancing:

```
bgp# ibgp-ecmp-method traffic-balance
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **BGP Global**. | The Edit BGP Global Parameters window opens. |
| 5. Set the **IBGP ECMP Method** parameter. Click on **Help** or see the parameter description on page A-9. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

# Configuring EBGP for Route and Traffic-Load Balancing

EBGP route balancing and traffic-load balancing are two techniques that allow an EBGP speaker to distribute routes to the same destination among multiple equal-cost paths.

In both techniques, EBGP uses equal cost multipath (ECMP) routes submitted statically to the IP routing table. (Although unusual for EBGP connections, the ECMP routes could also be submitted by OSPF or RIP.) For information about ECMP routing, see Chapter 4.

You can configure an EBGP speaker to use ECMP static routes in the IP routing table for route balancing and traffic-load balancing.

The following conditions must apply:

- The local BGP router and the remote BGP router must be connected by multiple links.
- IP must be configured on a circuitless interface on both the local and remote routers.
- The EBGP speaker on the local router and the EBGP speaker on the remote router must establish a peer-to-peer session using their circuitless IP interfaces. For information, see “Using the Circuitless IP Interface for a Peer-to-Peer Session” on page 8-58.
- The local IP routing table must contain multiple equal-cost routes to the circuitless interface of the router in the remote AS. These ECMP routes are typically submitted statically, but they could also be submitted by OSPF or RIP.

In Figure 8-9, for example, two BGP routers located in different ASs are connected by two physical links.

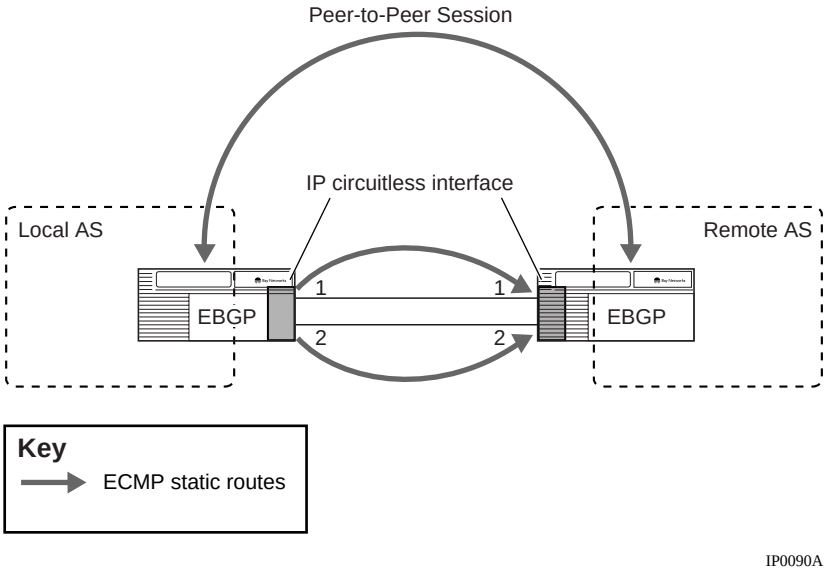


**Figure 8-9. ECMP Static Routes**

Assume that the IP routing table in the BGP router in AS 1 contains two ECMP static routes to the circuitless interface of the BGP router in AS 2. One ECMP route uses interface 1; the other route uses interface 2.

Assume also that the two EBGP speakers have established a peer-to-peer session, using their circuitless IP interfaces.

Now assume that the local EBGP speaker has received from its remote peer advertisements for routes to three destinations: destination_1, destination_2, and destination_3.

If you configure the local EBGP speaker for ECMP *route balancing*, BGP submits one BGP route to the routing table for each BGP destination, using in turn (round-robin) the available ECMP routes, as follows:

1. BGP submits a BGP route to destination_1 and specifies interface 1 as the next hop.
2. BGP submits a BGP route to destination_2 and specifies interface 2 as the next hop.

3. BGP submits a BGP route to destination_3 and specifies interface 1 as the next hop.

If you configure EBGP for *traffic balancing*, BGP submits multiple BGP routes, one for each static ECMP route, in the following manner:

1. BGP submits two routes to destination_1. One route specifies interface 1; the second route specifies interface 2.
2. BGP submits two IP routes to destination_2. One route specifies interface 1; the second route specifies interface 2.
3. BGP submits two IP routes to destination_3. One route specifies interface 1; the second route specifies interface 2.

You can use the BCC or Site Manager to configure EBGP for ECMP route balancing and traffic-load balancing.

### *Using the BCC*

Navigate to the BGP global prompt and enter:

**ebgp-ecmp-method** <*method*>

*method* is one of the values shown in Table 8-16.

**Table 8-16. EBGP ECMP Methods**

| Method | Meaning |
|---|---|
| route-balance | BGP submits one BGP route to the IP routing table for each BGP destination, using in turn (round-robin) the available ECMP routes to the next hop. |
| traffic-balance | BGP submits multiple routes to IP, using all known IGP ECMP IP next hops. |

For example, the following sequence of BCC commands:

1. Configures an IP circuitless interface (201.1.1.1) on the local router's virtual circuit.
2. Configures two static routes to destination 201.1.1.4, the IP circuitless interface on the remote router.
3. Assigns router ID 201.1.1.1 to BGP on the local router.
4. Associates local BGP with AS 11.
5. Configures local BGP for multihop peer-to-peer sessions.
6. Establishes a BGP peer-to-peer session between virtual interface 201.1.1.1 on the local router and virtual interface 201.1.1.4 on the remote router.
7. Configures the peer-to-peer session for route balancing.

```
box# virtual
virtual# ip 201.1.1.1/30
ip/201.1.1.1/255.255.0.252# box
box# ip
ip# static-route 201.1.1.4/30/198.2.1.1
static-route/201.1.1.4/255.255.0.0/198.2.1.1# back
ip# static-route 201.1.1.4/30/192.32.28.51
static-route/201.1.1.4/255.255.0.0/192.32.28.51# back
ip# bgp
bgp# router-id 201.1.1.1
bgp# local-as 11
bgp# multi-hop enabled
bgp# peer 201.1.1.1/201.1.1.4 as 12
peer/201.1.1.1/201.1.1.4# ebgp-ecmp-method route-balance
peer/201.1.1.1/201.1.1.4# back
bgp#
```

### *Using Site Manager*

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **BGP**. | The BGP menu opens. |
| 4. Choose **Peers**. | The IP Interface List for BGP window opens. |
| 5. Click on the IP interface for which you want to edit BGP peer parameters. | |
| 6. Click on **BGP Peers**. | The BGP Peer List window opens. |
| 7. Click on the peer for which you want to edit parameters. | The parameters for that peer appear in the window. |
| 8. Set the **Peer EBGP ECMP** parameter. Click on **Help** or see the parameter description on page A-17. | |
| 9. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the IP Interface List for BGP window. |

# Configuring EBGP Route Flap Dampening

The frequent change of network reachability information that can be caused by an unstable route is commonly referred to as *route flap*. Route flap *dampening* is a technique for suppressing information about unstable routes.

BayRS supports dampening of unstable EBGP routes. The route flap dampening mechanism performs the following functions:

- Determines the stability of an EBGP route
- Suppresses the use and advertisement of unstable EBGP routes
- Unsuppresses a route that has regained stability

To determine the stability of a route in the IP routing table, BGP maintains a *penalty value* for the route based on its recent history. Each time the route flaps (that is, each time it is withdrawn from the routing table), BGP increments this penalty value. During the period of time that the route does not flap, BGP decrements the penalty value. In this way, as the instability of the route increases, the penalty value rises. As the route becomes more stable, the penalty value falls.

To monitor BGP for route flaps, you set the route dampening parameter on a BGP accept policy that matches the route. BGP creates a penalty value for the route and sets the value to 0. BGP increments the penalty each time the route flaps.

BGP provides a a *route flap dampening template* that allows you to control the way BGP evaluates a route's penalty and how, based on the penalty, it decides to suppress or unsuppress the route. The template consists of the following parameters:

- Cutoff threshold. If the penalty value rises above the value that you specify as the cutoff threshold, BGP suppresses the route.
- Reuse threshold. If the penalty value falls below the value that you specify as the reuse threshold, BGP unsuppresses the route.
- Reachable decay. If the route is still reachable after the period of time that you specify, BGP reduces the penalty value by half. (BGP uses a half-life decay algorithm to decrement the penalty value.)
- Unreachable decay. If the route is still unreachable after the period of time that you specify, BGP reduces the penalty value by half. (BGP uses a half-life decay algorithm to decrement the penalty value.)

- Maximum holddown time. If the route remains suppressed after the number of minutes that you specify, BGP unsuppresses it (even if the penalty value exceeds the threshold). This action does not change the penalty value.
- Memory limit. If the status of the route remains unchanged, either reachable or unreachable, after the number of minutes that you specify, BGP unsuppresses the route (if it is suppressed) and resets the penalty value and flap count to 0.

BGP provides a default template. You can also use the BCC or Site Manager to create a route flap dampening template and a BGP accept policy for route flap dampening.

### *Using the BCC*

To create a route-flap-dampening template, navigate to the global BGP prompt and enter:

**damping-template name** *<name>*

*name* is a unique name identifying the template.

A template-specific prompt appears.

For example, the following command creates a route-flap-dampening template named ralph.

```
bgp# damping-template name ralph
damping-template/ralph#
```

To define the attributes of a template you created, navigate to the template-specific prompt and enter:

*<attribute> <value>*

*attribute value* is one of the combinations described in Table 8-17.

**Table 8-17. Route-Flap-Dampening Template Parameters**

| Attribute | Value/Default | Meaning |
|---|---|---|
| cut-off-threshold | Integer/2000 | Specifies a maximum threshold (1 through 20,000) for the route penalty value |
| reuse-threshold | Integer/750 | Specifies a minimum threshold (1 through 20,000) for the route penalty value |
| reachable-decay | Number of minutes/ 5 | Specifies the number of minutes (1 through 45) that the route must remain reachable before BGP decrements the penalty value by half |
| unreachable-decay | Number of minutes/ 15 | Specifies the number of minutes (1 through 45) that the route must remain unreachable before BGP decrements the penalty value by half |
| max-holddown | Number of minutes/ 45 | Specifies the maximum number of minutes (1 through 60) that a route can remain suppressed |
| memory-limit | Number of minutes/ 45 | Specifies the maximum number of minutes (1 through 60) that the status of a route can remain unchanged -- reachable or unreachable -- before BGP resets the penalty value and flap count to 0 and unsuppresses the route |

To apply the template to an inbound BGP routing update:

1. **Create and name a BGP accept policy.**

   For instructions on creating a BGP accept policy, see “Defining a BGP Accept Policy” on page 8-64.

   An accept policy-specific prompt appears.

2. **Modify the accept policy by entering the following commands:**

   **action accept**

   **route-damping enabled**

   **route-damping-template** *<name>*

   *name* is the name of the template that you want to apply to the unstable route.

3. **Match the accept policy to the unstable route.**

   For instructions, see “Specifying Matching Criteria for a BGP Accept Policy” on page 8-70.

For example, the following sequence of commands creates a BGP accept policy named fred that causes BGP to apply route-flap-dampening template ralph to updates for network 3.4.5.6:

```
bgp# accept fred
accept/fred/bgp# action accept
accept/fred/bgp# route-damping enabled
accept/fred/bgp# route-damping-template ralph
accept/fred/bgp# match
match/bgp/accept/fred# network 3.4.5.6/16/exact
network/3.4.5.6/255.255.0.0/exact/bgp/accept/fred#
```

### *Using Site Manager*

To create a route-flap-dampening template, complete the following tasks:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Policy Filters**. | The Policy Filters menu opens. |
| 4. Choose **BGP-4**. | The BGP-4 menu opens. |
| 5. Choose **Accept Policies**. | The BGP4 Accept Policy Filters window opens. |
| 6. Click on **Route Flap**. | The Route Flap Dampening List window opens. |
| 7. Click on **Add**. | The Route Flap Dampening Configuration window opens. |
| 8. Set the following parameters:<br>• **Name**<br>• **Cutoff Threshold**<br>• **Reuse Threshold**<br>• **Reachable Decay**<br>• **Unreachable Decay**<br>• **Max HoldDown**<br>• **Memory Limit**<br>Click on **Help** or see the parameter descriptions beginning on page B-21. | |
| 9. Click on **OK**. | You return to the Route Flap Dampening List window. |
| 10. Click on **Done**. | You return to the BGP4 Accept Policy Filters window. |

To apply a route-flap-dampening template to an existing BGP accept policy, complete the following tasks:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Policy Filters**. | The Policy Filters menu opens. |
| 4. Choose **BGP-4**. | The BGP-4 menu opens. |
| 5. Choose **Accept Policies**. | The BGP4 Accept Policy Filters window opens. |
| 6. Click on the accept policy to which you want to apply route flap dampening. | The BGP4 Accept Policy Filters window opens. |
| 7. Set the following parameters:<br>• **BGP Route Flap Dampening**<br>• **BGP Route Flap Dampening Template**<br>Click on **Help** or see the parameter descriptions beginning on page B-20. | |
| 8. Click on **Done**. | You return to the BGP4 Accept Policy Filters window. |

# Chapter 9
# Customizing EGP Services

This chapter explains how to configure the Exterior Gateway Protocol (EGP).


| Topic | Page |
|---|---|
| EGP Concepts and Terminology | 9-2 |
| Customizing EGP on the Router | 9-6 |
| Configuring a Neighbor | 9-8 |

# EGP Concepts and Terminology

EGP-2 is an exterior gateway protocol used to exchange network reachability information between routers in different autonomous systems. In each, AS routers share routing information using one or more interior gateway protocols -- for example, RIP or OSPF. The routers that serve as end points of a connection between two ASs run an exterior gateway protocol, such as EGP-2 (Figure 9-1).

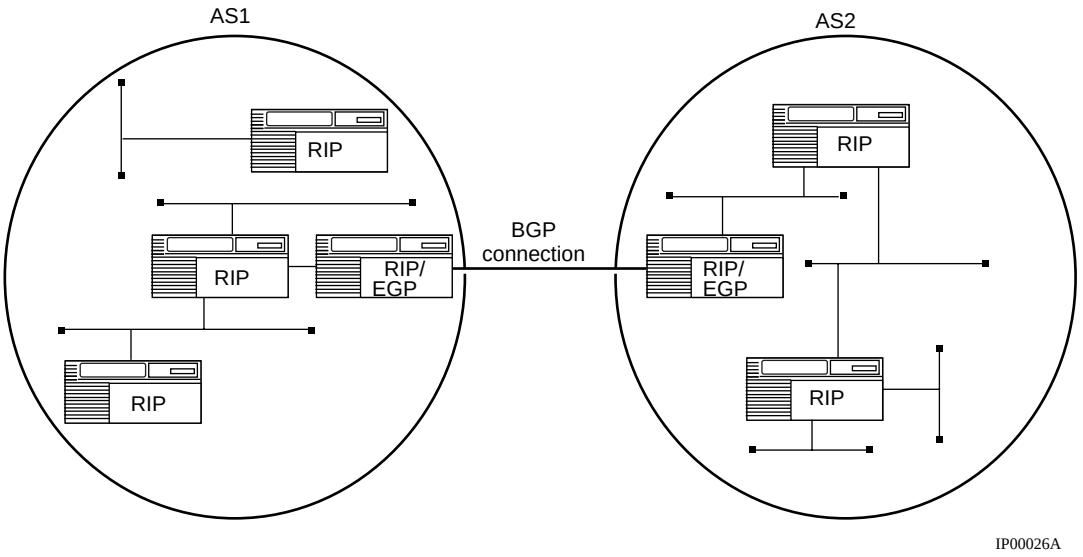


**Figure 9-1. EGP Connection Between Two Autonomous Systems Running RIP**

The Bay Networks implementation of EGP complies with RFCs 827 and 904. It runs over the same LAN and WAN media/protocols that IP runs over, including Ethernet, token ring, synchronous, Wellfleet Proprietary Synchronous, frame relay, SMDS, X.25 (DDN, PDN, Pt-to-Pt), ATM PVC, FDDI, T1, E1, HSSI, and PPP.

**Note:** EGP assumes that each advertised network is a natural class network (A, B, or C) based on its high-order bits. EGP cannot advertise or interpret subnets or supernets.

An EGP router does the following:

- Acquires EGP neighbors
- Determines neighbor reachability
- Exchanges network reachability information with its neighbors

Each of these capabilities has an associated phase in EGP: the neighbor acquisition phase, the neighbor reachability phase, and the network reachability phase, respectively.

In the acquisition phase, EGP is responsible for forming neighbor relationships between routers that are peers. Routers that are peers each have an interface to a common network. One router attempts to acquire a peer router. If the peer agrees to be acquired, the two routers form a neighbor relationship. They then negotiate the mode of operation and the polling modes.

After two routers agree to form a neighbor relationship, they must then negotiate modes. According to EGP, the routers' modes are determined as shown in Table 9-1.

**Table 9-1. Router Mode Determinator**

| Router A | Router B | Resulting Modes |
|---|---|---|
| Active | Passive | Router A is active; Router B is passive. |
| Passive | Passive | Not allowed; at least one router must be active. |
| Active | Active | The router with the lower autonomous system number becomes active; the other becomes the passive router. |
| Both | Active | Router A is passive; Router B is active. |
| Both | Passive | Router A is active; Router B is passive. |
| Both | Both | The router with the lower autonomous system number becomes active; the other becomes the passive router. |

Table 9-1 shows all possible acquisition mode combinations that are available when you configure the EGP neighbors at each end of a connection. However, Bay Networks recommends that one router be configured in the active acquisition mode and the other in the passive acquisition mode.

In the neighbor reachability phase, EGP is responsible for monitoring and maintaining an established EGP neighbor relationship between two routers. Its purpose is to ensure that the neighbors are operational and can provide reliable network reachability information. Two neighbors will be able to exchange network reachability information only if they are both in the up state and know that they are both in the up state. This is the point at which neighbor reachability is positively determined.

In the network reachability phase, EGP is responsible for determining which networks are reachable through two EGP neighbors; that is, it provides the network reachability information. This information provides a list of gateways, the networks those gateways can reach, and their associated distances.

Two neighbors determine network reachability by exchanging poll messages and routing update responses as follows:

- The active neighbor sends a poll message to a passive neighbor that it already knows to be reachable. The poll message requests routing information from the passive neighbor.
- The routing update response contains the routing information (the list of gateways on the common network, the networks they can reach, and associated distances). Both active and passive neighbors can send routing update messages. The active neighbor usually sends a routing update response after it sends a poll message. The passive neighbor usually sends a routing update response in response to a poll message.

## EGP Implementation Notes

This section provides you with some important guidelines to follow when you configure EGP. If you do not follow these guidelines, EGP will become disabled on the interfaces involved.

- Autonomous system numbers must be from 1 to 65,535.
- Two autonomous systems connected by an EGP link must have different autonomous system numbers.
- The remote IP address cannot be the same as any of the local IP interface addresses.
- The remote IP address must be on the same subnet as one of the local IP interfaces.
- EGP does not have any loop avoidance techniques -- avoid loop topologies; otherwise, you will have to configure EGP route filters to counter the redundancies.
- An EGP configuration between two ASs, each using a subnetted interface to a class A network, results in a routing black hole. RIP Version 1 aggregates the single subnet into the natural network, but the gateway router does not have complete subnet information or a natural network route to match the one being advertised by RIP Version 1. This black hole is not an EGP or RIP defect: rather, it is caused by the way RIP aggregates subnets into natural networks.

  EGP will operate over a subnetted interface between two Bay Networks routers if a static route is implemented. The router accepting the subnet from the remote network must augment the single subnet information with a static route for the entire remote network.

# Customizing EGP on the Router

You customize EGP on the router by setting EGP global parameters as described under the following topics:


| Topic | Page |
|---|---|
| Enabling and Disabling EGP | 9-6 |
| Supplying a Local AS Number | 9-7 |


## Enabling and Disabling EGP

When you start EGP on the router, EGP is automatically enabled for operation.

You can use Site Manager to disable and reenable EGP.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **EGP**. | The EGP menu opens. |
| 4. Choose **Global**. | The Edit EGP Global Parameters window opens. |
| 5. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-23. | The Values Selection window opens. |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Supplying a Local AS Number

Each autonomous system has a NIC-assigned decimal number ID.

You must supply the AS ID for the local autonomous system (the AS to which this router belongs). There is no default for this parameter.

You can use Site Manager to supply the local AS number.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **EGP**. | The EGP menu opens. |
| 4. Choose **Global**. | The Edit EGP Global Parameters window opens. |
| 5. Set the **Local Autonomous System ID** parameter. Click on **Help** or see the parameter description on page A-23. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

# Configuring a Neighbor

You define a neighbor-to-neighbor relationship by setting EGP neighbor parameters as described under the following topics:


| Topic | Page |
|---|---|
| Specifying the Neighbor's Address | 9-9 |
| Specifying the Gateway Mode | 9-10 |
| Enabling and Disabling the Neighbor Relationship | 9-11 |
| Choosing the Acquisition Mode | 9-12 |
| Choosing the Poll Mode | 9-13 |
| Setting Neighbor Timers | 9-14 |

## Specifying the Neighbor's Address

You define the neighbor-to-neighbor relationship by specifying the IP address of the router that is to be the remote neighbor.

You can use Site Manager to supply the address of the remote neighbor.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **EGP**. | The EGP menu opens. |
| 4. Choose **Neighbors**. | The IP Interface List for EGP window opens. |
| 5. Click on the IP interface for which you want to specify the neighbor's address. | The parameter values for that interface appear in the window. |
| 6. Set the **Remote Autonomous System IP Address** parameter. Click on **Help** or see the parameter description on page A-24. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Specifying the Gateway Mode

You can configure the EGP router to operate in one of two gateway modes for any given IP interface:

- *Noncore*. When the router is configured as a noncore gateway, the AS to which it belongs acts as a stub AS. It advertises and forwards only traffic that originated or is destined for a network within its AS.
- *Core*. When the router is configured as a core gateway, the AS to which it belongs acts as a transit AS. In the core mode, it can advertise and forward traffic to networks that are reachable inside or outside of its local AS.

If you choose noncore mode, the AS to which this EGP neighbor belongs will act as a stub AS. That is, it will advertise only networks that reside within the AS.

The default gateway mode is core mode. If the EGP router is reconfigured to run in noncore mode, the Site Manager *automatically* configures EGP export route filters on that IP interface. This action suppresses OSPF external routes to EGP and the advertisement of any networks learned by EGP.

You can use Site Manager to specify the gateway mode of this EGP neighbor.

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **EGP**. | The EGP menu opens. |
| 4. Choose **Neighbors**. | The IP Interface List for EGP window opens. |
| 5. Click on the IP interface you want. | The parameter values for that interface appear in the window. |
| 6. Set the **Gateway Mode** parameter. Click on **Help** or see the parameter description on page A-24. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Enabling and Disabling the Neighbor Relationship

When you establish a neighbor-to-neighbor relationship on an interface, the relationship is automatically enabled.

You can use Site Manager to temporarily disable this neighbor relationship rather than delete it.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **EGP**. | The EGP menu opens. |
| 4. Choose **Neighbors**. | The IP Interface List for EGP window opens. |
| 5. Click on the IP interface you want. | The parameter values for that interface appear in the window. |
| 6. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-25. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Choosing the Acquisition Mode

In an EGP neighbor relationship, one router is the active neighbor and the other router is the passive neighbor. The router in the active mode is the initiator.

By default, EGP assumes that the remote router is the passive neighbor.

You can use Site Manager to identify the remote router as the active neighbor.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **EGP**. | The EGP menu opens. |
| 4. Choose **Neighbors**. | The IP Interface List for EGP window opens. |
| 5. Click on the IP interface you want. | The parameter values for that interface appear in the window. |
| 6. Set the **Acquisition Mode** parameter. Click on **Help** or see the parameter description on page A-25. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Choosing the Poll Mode

The type of neighbor reachability algorithm executed by the local EGP neighbor is called the poll mode. There are two poll modes: active and passive. In the active mode, a router sends hello and poll messages to request reachability status from its neighbor. In the passive mode, a router responds to hello and poll messages with I-H-U and update messages.

By default, EGP is configured to execute both the active and passive poll mode. You can use Site Manager to execute the active or passive mode only.

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **EGP**. | The EGP menu opens. |
| 4. Choose **Neighbors**. | The IP Interface List for EGP window opens. |
| 5. Click on the IP interface you want. | The parameter values for that interface appear in the window. |
| 6. Set the **Poll Mode** parameter. Click on **Help** or see the parameter description on page A-25. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## Setting Neighbor Timers

EGP uses two configurable timers: the hello timer and the poll timer.

The hello timer determines the number of seconds between the local EGP neighbor's EGP hello message retransmissions. This variable represents the RFC 904 T1 timer. By default, EGP sends a hello message every 60 seconds.

You can use Site Manger to supply a value between 30 and 120 seconds.

The poll timer determines the interval between the local EGP neighbor's EGP poll message retransmissions. This variable represents the RFC 904 T2 timer. By default, EGP retransmits a poll message every 180 seconds. You can use Site Manager to specify a value between 120 and 480 seconds.

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **EGP**. | The EGP menu opens. |
| 4. Choose **Neighbors**. | The IP Interface List for EGP window opens. |
| 5. Click on the IP interface for which you want to specify the neighbor's address. | The parameter values for that interface appear in the window. |
| 6. Set the following parameters:<br>• **Hello Timer**<br>• **Poll Timer**<br>Click on **Help** or see the parameter descriptions beginning on page A-26. | |
| 7. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Chapter 10
# Configuring RIPSO on an IP Interface

IP routers support the Department of Defense (DoD) Revised IP Security Option (RIPSO), as defined in RFC 1108, on a per-interface basis. While RIPSO RFC 1108 specifies both “basic” and “extended” security options, the Bay Networks implementation supports only the basic option.

RIPSO is a feature that allows end systems and intermediate systems (routers) to add labels to or process security labels in IP datagrams that they transmit or receive on an IP network. The labels specify security classifications (for example, Top Secret Confidential and Unclassified, in descending order), which can limit the devices that can access these labeled IP datagrams.

As a labeled IP datagram traverses an IP network, only those systems that have the proper clearance (that is, whose security classification range covers the classification specified by the datagram) should accept and forward the datagram.

Any system whose security classification range does not cover the classification specified by the security label should drop the datagram.

**Note:** RIPSO does not include any method of preventing a system that does not support RIPSO from simply accepting and forwarding labeled datagrams. Thus, in order for RIPSO to be effective, *all* systems in a network must support RIPSO and process IP datagrams as described.

By default, RIPSO is disabled on IP interfaces. You can use Site Manager to enable RIPSO on an IP interface, and specify:

- A range of acceptable security levels for IP datagrams the interface receives and transmits
- A set of required and allowed authority values for IP datagrams the interface receives and transmits
- Whether inbound datagrams received on this interface require security labels
- Whether outbound datagrams transmitted on this interface (either forwarded or originated by the router) require security labels
- Whether datagrams received or transmitted on this interface should have their labels stripped

You also specify whether the router creates the following types of labels:

- An implicit label, which the router uses to label unlabeled inbound datagrams, when required
- A default label, which the router uses to label unlabeled outbound datagrams, when required
- An error label, which the router uses to label ICMP error messages associated with processing security options

## Security Label Format

A RIPSO security label is three or more bytes long and specifies the security classification level and protection authority values for the datagram (Figure 10-1).

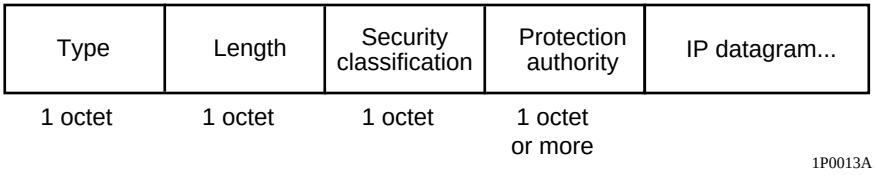


**Figure 10-1. RIPSO Security Label**

The format of the security label is as follows:

- Octet 1 contains a type value of $82_{(16)}$, identifying the basic security option format.
- Octet 2 specifies the length of the option (three or more octets, depending on the presence or absence of authority flags).
- Octet 3 specifies the security classification levels for the datagrams. Valid security classification levels include:

| | |
|---|---|
| $3D_{(16)}$ | Top Secret |
| $5A_{(16)}$ | Secret |
| $96_{(16)}$ | Confidential |
| $AB_{(16)}$ | Unclassified |

- Octet 4 and beyond identify the protection authorities under whose rules the datagram is classified at the specified level. (If no authorities have been identified, then this field is not used.)

  The first 7 bits (0 to 6) are flags. Each flag represents a protection authority. The flags defined for octet 4 are as follows:

| | | |
|---|---|---|
| Bit 0 | GENSER | General Services (as per DoD 5200.28) |
| Bit 1 | SIOP-ESI | DoD (Organization of the Joint Chiefs of Staff) |
| Bit 2 | SCI | Central Intelligence Agency |
| Bit 3 | NSA | National Security Agency |
| Bit 4 | DOE | Department of Energy |
| Bit 5 | Reserved | |
| Bit 6 | Reserved | |
| Bit 7 | Termination indicator | |

**Note:** Bit 7 acts as a “more” bit, indicating that another octet (containing additional authority flags) follows.

## Inbound IP Datagrams

When the router receives an IP datagram on a RIPSO interface, it compares the security classification and authority values specified in the security label with those configured on the inbound interface.

If the interface does *not* require a security label for inbound IP datagrams, then the router accepts both unlabeled IP datagrams and datagrams that meet the classification and authority rules described in the next paragraph.

If the interface *does* require a security label, then for the router to accept the datagram, the following RISPO conditions must be met:

- The datagram must be labeled.
- The security classification value in the datagram's label must be within the security-level range configured for the interface.
- The authority flags in the datagram's label must include all of the flags required for the interface and cannot contain any flags not allowed for the interface.

The router drops any datagrams that do not meet these requirements and generates an ICMP error message.

On a *non-RIPSO* interface, the router accepts only unlabeled IP datagrams and IP datagrams that are labeled as Unclassified with no authority flags set.

## Forwarded IP Datagrams

When the router receives an IP datagram that needs forwarding on a RIPSO interface, the router compares the security classifications and authority values specified in the security label with those configured on the outbound interface. Before forwarding the datagram, the router:

- Checks that all RIPSO conditions are met (see the preceding section)
- Applies any outbound-specific configuration parameters

The router drops any datagrams that do not meet these requirements and generates an ICMP error message.

## Originated IP Datagrams

When the router originates a datagram and the following conditions are true, the router labels the datagram with the default security label before transmitting it:

- The datagram needs forwarding through a RIPSO interface.
- The RIPSO interface requires outbound labels for originated datagrams.

## Unlabeled IP Datagrams

If the router receives an unlabeled IP datagram from an interface on which RIPSO is *not* enabled (or on which labels are not required for inbound datagrams), and the IP datagram needs forwarding to an interface on which RIPSO *is* enabled and labels are required for outbound datagrams, then the router labels the datagram, using either an implicit label or default label as follows:

- If the inbound interface has an implicit label configured, then the router uses it to label the datagram.
- If the inbound interface does not have an implicit label configured, then the router labels the datagram with the default label configured for the outbound interface.

If the interface does not have an implicit or default label configured, then the datagram is simply dropped.

# Enabling and Disabling RIPSO

Use Site Manager to enable or disable RIPSO on an interface. When you disable RIPSO, the router accepts only the following IP datagrams: labeled IP datagrams with the classification level set to Unclassified and no authority flags set, and unlabeled IP datagrams.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interfaces window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interfaces window. |
| 5. Set the **Enable Security** parameter. Click on **Help** or see the parameter description on page A-57. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Specifying the IP Datagram Type for Stripping Security Options

Use Site Manager to choose the type of IP datagram from which you want IP security options to be removed. Options are:

- None. The router leaves IP security options on all inbound and outbound IP datagrams intact.
- Incoming. The router strips the IP security option from each incoming IP datagram after checking the IP datagram against the interface's security configuration.
- Outgoing. The router strips the IP security option from each outgoing IP datagram before checking each datagram against the interface's security configuration.
- All. The router strips the IP security options from both incoming and outgoing IP datagrams: incoming datagrams after checking each against this interface's security configuration, and outgoing datagrams before checking each against the interface's security configuration.

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interfaces window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interfaces window. |
| 5. Set the **Strip Security** parameter. Click on **Help** or see the parameter description on page A-58. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Specifying the Outbound Datagram Type Requiring Security Labels

Use Site Manager to specify the type of outbound datagrams that require IP security labels. Options are:

- None. The router forwards unlabeled IP datagrams unchanged on this interface. In addition, those IP datagrams that it originates and transmits do not require labels.
- Forwarded. All IP datagrams the router forwards on this interface (not those it originates) must contain basic IP security options. If the datagram already contains an IP security label, the router forwards the datagram unchanged. If the datagram is unlabeled, the router adds the implicit or default label to the datagram before forwarding it.
- Originated. The router specifies basic IP security options for all IP datagrams it originates and transmits on this interface. The router adds the default label to IP datagrams it originates and transmits on this interface.
- All. All datagrams (both those that the router forwards and those it originates) on this interface must contain basic IP security options. RIPSO supplies the implicit or default label for those datagrams that do not already contain one.

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interfaces window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interfaces window. |
| 5. Set the **Require Out Security** parameter. Click on **Help** or see the parameter description on page A-59. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Specifying the Inbound Datagram Type Requiring Security Labels

Use Site Manager to specify the type of inbound datagrams that require IP security labels. Options are:

- None. Inbound IP datagrams are not required to contain labels.
- All. All inbound IP datagrams received on this interface must contain basic IP security options.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interfaces window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interfaces window. |
| 5. Set the **Require In Security** parameter. Click on **Help** or see the parameter description on page A-59. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Setting the Security Level for IP Datagrams

Use Site Manager to specify the minimum and maximum security level that the router allows for inbound or outbound IP datagrams. The minimum and maximum security level features specify the range of classification levels that the router will accept and process. The router drops IP datagrams it receives on this interface that are below the minimum and above the maximum levels you specify.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interfaces window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interfaces window. |
| 5. Set the following parameters:<br>• **Min Level**<br>• **Max Level**<br>Click on **Help** or see the parameter descriptions beginning on page A-60. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Choosing Authority Flags in Outbound Datagrams

Use Site Manager to specify which authority flags *must* be set, and which authority flags *may* be set in the protection authority field of all outbound datagrams.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interfaces window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interfaces window. |
| 5. Set the following parameters:<br>• **Must Out Authority**<br>• **May Out Authority**<br>Click on **Help** or see the parameter descriptions beginning on page A-61. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Choosing Authority Flags in Inbound Datagrams

Use Site Manager to specify which authority flags *must* be set, and which authority flags *may* be set in the protection authority field of all inbound datagrams.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interfaces window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interfaces window. |
| 5. Set the following parameters:<br>• **Must In Authority**<br>• **May In Authority**<br>Click on **Help** or see the parameter descriptions beginning on page A-62. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Supplying Implicit Labels for Unlabeled Inbound Datagrams

Use Site Manager to specify whether the router should supply implicit labels to unlabeled inbound datagrams received by an interface. The router uses the Implicit Authority and Implicit Level fields to create an implicit label. By default, implicit labeling is enabled.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interfaces window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interfaces window. |
| 5. Set the following parameters:<br>• **Implicit Label**<br>• **Implicit Authority**<br>• **Implicit Level**<br>Click on **Help** or see the parameter descriptions beginning on page A-63. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Enabling and Disabling Default Labels for Unlabeled Outbound Datagrams

Use Site Manager to specify whether you want the router to supply a default label to unlabeled outbound datagrams originated or forwarded out this interface. The router uses the Default Authority and Default Level fields to create a default label.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interfaces window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interfaces window. |
| 5. Set the following parameters:<br>• **Default Label**<br>• **Default Authority**<br>• **Default Level**<br>Click on **Help** or see the parameter descriptions beginning on page A-65. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

# Enabling and Disabling Error Labels for Outbound ICMP Error Datagrams

Use Site Manager to specify whether you want the router to supply an error label to outbound ICMP error datagrams. The router uses the Error Authority and Min Level fields to create an error label.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **Interfaces**. | The IP Interfaces window opens. |
| 4. Click on the interface you want to edit. | Site Manager displays the parameter values for that interface in the IP Interfaces window. |
| 5. Set the following parameters:<br>• **Error Label**<br>• **Error Authority**<br>Click on **Help** or see the parameter descriptions beginning on page A-66. | |
| 6. Click on **Apply**, and then click on **Done**. | Site Manager returns you to the Configuration Manager window. |

## RIPSO Example

The router in Figure 10-2 has RIPSO configured on all three IP interfaces. The security ranges specified for each interface vary, as shown. (For simplicity, this example assumes that none of the interfaces requires any authority flags on inbound and outbound traffic, but any flags that are present are acceptable.)

When host 1.1.0.1 broadcasts an all-subnets broadcast IP datagram with the security-level classification set to Secret, the router compares the datagram's classification with the range configured on inbound interface 1.1.0.2. Because the Secret security level is within the range configured on the interface, the router accepts the datagram. In order to forward the datagram, the router does the following:

- Compares the datagram's security level, Secret, to the security-level ranges configured on interfaces 1.2.0.2 and 1.3.0.2
- Forwards the datagram on interface 1.2.0.2, because Secret is within the security range configured on the interface
- Does *not* forward the datagram on interface 1.3.0.2, because Secret is outside the security range configured on the interface

| Interface | Min. Security Classification | Max. Security Classification |
|---|---|---|
| 1.1.01 | Unclassified | Top secret |
| 1.2.02 | Secret | Top secret |
| 1.3.0.2 | Top secret | Top secret |

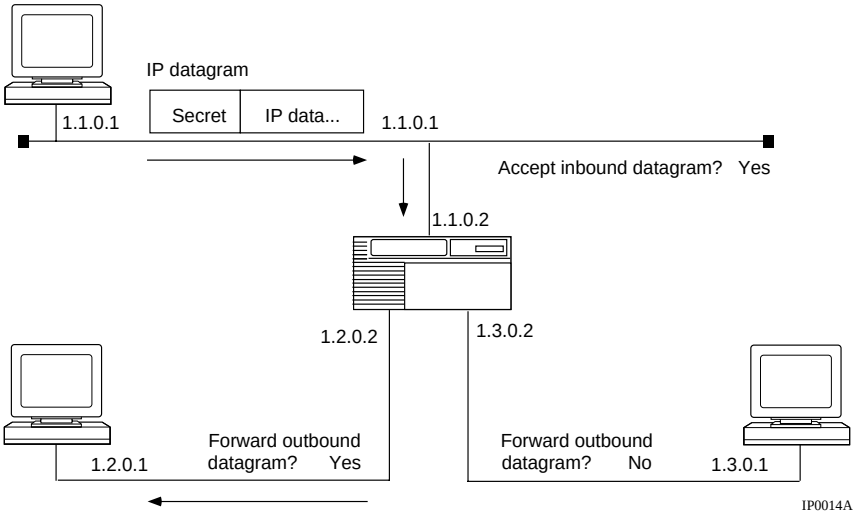


**Figure 10-2. RIPSO Example**

# Chapter 11
# Connecting the Router to a Blacker Front End

The Blacker front end (BFE) is a classified encryption device used by hosts that want to communicate across unsecured wide area networks. BFE devices are typically found in government networks (for example, DSNET), which handle sensitive data requiring a greater degree of security.

Blacker front-end support allows the router to connect to BFE devices. The BFE device, in turn, provides the router with encryption services while acting as the data communications equipment (DCE) end of the connection between the router and the X.25 network (Figure 11-1).

Hosts using attached BFE devices can communicate with each other over an unsecured packet-switched network using data paths secured by the encryption services of the BFEs. These hosts are part of a *red* virtual network. The packet-switched network that carries both the data secured by BFEs and any other unsecured data is known as the *black* network.

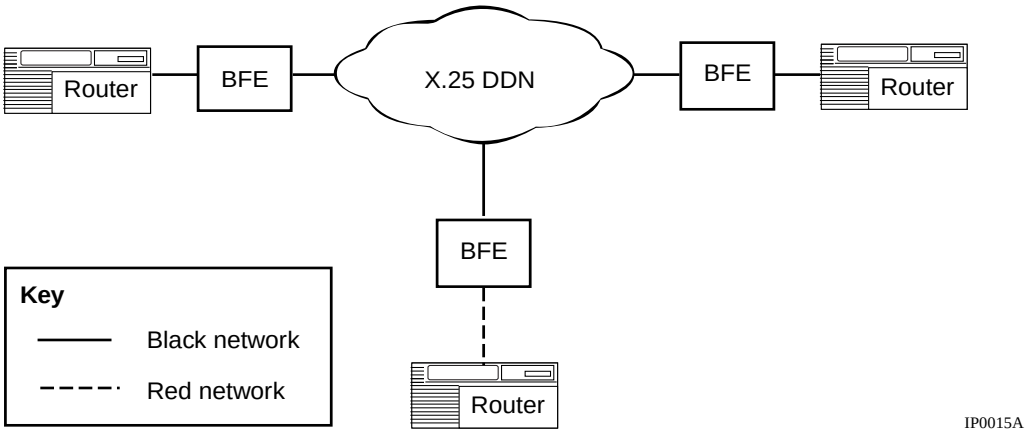


**Figure 11-1. Blacker Front-End Network Configuration**

BFE devices receive authorization and address translation services from an access control center (ACC) residing on the black network. The ACC makes access control decisions that determine which hosts are allowed to communicate with each other. A key distribution center (KDC) residing on the black network provides encryption keys and key management services. A BFE device uses these encryption keys for encrypting traffic between itself and other BFE devices.

The router-to-BFE interface is a modified version of the interface presented in the 1983 DDN X.25 Host Interface Specification. It supports data rates between 1200 b/s and 64 KB/s. In order to support BFE services, the interface must be configured to support IP with the Revised IP Security Option (RIPSO) enabled. All IP datagrams transmitted on the interface must contain a RIPSO security label. The first option in each IP datagram header must be the Basic Security option.

# BFE Addressing

You can enable BFE support on individual IP interfaces. When you enable BFE support, the router uses the BFE address-resolution algorithm to map IP addresses to their corresponding X.121 addresses.

BFE IP-to-X.121 address translation differs from standard DDN address translation. Each physical router-to-BFE connection is identified by a BFE X.121 network address and a BFE IP address. The format of a BFE X.121 address is:

*zzzzzpdddbbb*

| | |
|---|---|
| *zzzzz* | is zero |
| *p* | is the BCD encoding of the port ID |
| *add* | is the BCD encoding of the domain ID |
| *bbb* | is the BCD encoding of the BFE ID |

All BFE hosts are members of Class A IP networks. The format of a BFE IP address is as follows:

*nnnnnnnn.Zpppdddd.dddddbb.bbbbbbbb*

| | |
|---|---|
| *nnnnnnnn* | identifies the network ID in bits |
| *Z* | is zero |
| *ppp* | is the port ID in bits |
| *dddd.dddddd* | is the domain ID in bits |
| *bb.bbbbbbbb* | is the BFE ID in bits |

BFE supports only physical addressing. It does not support either logical addresses or subaddresses.

# Configuring Blacker Front-End Support

To configure BFE support on an IP interface, you must:

- Configure an X.25 interface that conforms to the BFE requirements described in this section.
- Enable the IP routing protocol on the interface.
- Enable RIPSO support on the interface.

Beginning at the Configuration Manager window, perform the following procedures:

1. **Configure an X.25 interface.**

   When you initially configure packet-level parameters for the X.25 interface, make certain to:

   a. **Set the Network Address Type parameter to BFE_NETWORK.**

   b. **Set the DDN IP Address parameter to the IP address that is assigned to your BFE connection.**

2. **Edit the packet-layer parameters for the X.25 interface so that they match the settings specified in Table 11-1.**
3. **Add network service records to the X.25 interface.**
4. **Edit the network service record parameters for the X.25 interface so that they match the settings specified in Table 11-2.**

   Remember to set the DDN BFE parameter to Enable.

5. **Enable the IP routing protocol on the X.25 interface.**

   The specified IP address must match the one specified in the packet-layer parameter setting.

6. **Edit the IP interface record.**

   The address resolution must be set to X.25 BFE DDN. Also configure IP security options (RIPSO) on the interface. IP security must be enabled, and labels are required on all outbound data.

For instructions on performing steps 1 through 4, see *Configuring X.25 Services*. For instructions on performing steps 5 and 6, see Chapter 10.

**Note:** Generally, the synchronous line parameter settings are the same for both a DDN X.25 link and a BFE X.25 link. However, if your operating environment has specific needs, you may want to edit synchronous line parameters. See the appropriate protocol manual for instructions.

**Table 11-1. BFE X.25 Packet-Level Parameter Settings**

| Parameter | Setting |
|---|---|
| Enable | Enable |
| Network Address Type | BFE_NETWORK |
| PDN X.121 Address | Parameter is ignored |
| DDN IP Address | Specify the IP address assigned to your BFE connection. |
| Sequence Size | MOD8 |
| Restart Procedure Type | DTE_RESTART |
| Default Tx/Rx Window Size | Range is 2 to 7. This setting should match the default value configured in the BFE. This value should be coordinated with the X.25 service record value. |
| Default Tx/Rx Packet Length | Options include 128, 256, 512, and 1024. This setting should match the default value configured in the BFE. This value should be coordinated with the X.25 service record value. |
| Number of incoming SVC channels | Zero (0). BFE does not support the one-way logical channel incoming facility. |
| Incoming SVC LCN Start | Parameter is ignored |
| Number of outgoing SVC channels | Any valid nonzero setting |
| Bidirectional SVC LCN | Any valid nonzero setting |
| Number of outgoing SVC channels | Zero (0). BFE does not support the one-way logical channel outgoing facility. |
| Outgoing SVC LCN Start | Parameter is ignored |
| Number of PVC channels | Zero (0). BFE does not support PVCs. |
| PVC LCN Start | Parameter is ignored |
| T1 Timer, T2 Timer, T3 Timer, T4 Timer | BFE has no special requirements for any of these four parameters. |
| Flow Control Negotiation | Set to on if you do not want to use the default values configured in the BFE for this link. |

*(continued)*

**Table 11-1. BFE X.25 Packet-Level Parameter Settings** *(continued)*

| Parameter | Setting |
|---|---|
| Max Window Size | Range is 2 to 7. If you specify any setting other than the default value configured in the BFE, set Flow Control Negotiation to on.This value should be coordinated with the X.25 service record value. |
| Max Packet Length | Options include 128, 256, 512, and 1024. If you specify any value other than the default value configured in the BFE, then set Flow Control Negotiation to on. (If the IP interface is configured to support multiple IP security levels, then set to 1024.) This value should be coordinated with the X.25 service record value. |
| Trans/Recv Throughput Class | Parameter is ignored |
| Max Throughput Class | Parameter is ignored |
| Throughput Class Negotiation | Off |
| Network User Identification | Off |
| Incoming Calls Accept | On |
| Outgoing Calls Accept | On |
| Fast Select Accept | Off |
| Reverse Charge Accept | Off |
| Fast Select | Off |
| Reverse Charging | Off |
| CUG Selection | Null |
| CUG Outgoing Access | Null |
| CUG Bilateral Selection | Null |
| RPOA Selection | Off |
| Charging Information | Off |
| Transit Delay | Off |
| Full Addressing | On |
| Acceptance Format | Defext |
| Release Format | Defext |
| CCITT (now ITU-T) Conformance | DXE1980 |
| Network Standard | DOD |

**Table 11-2. BFE X.25 Network Service Record Parameter Settings**

| Parameter | Required Setting |
|---|---|
| Enable | Enable |
| Type | DDN |
| Connection ID | Parameter is ignored |
| Remote IP Address | Specify the IP address of the remote system. |
| Remote X.121 Address | Parameter is ignored |
| Broadcast | Parameter is ignored |
| Max Connections | Any valid setting |
| Precedence | Any valid setting. The BFE will accept, but not act on, the DDN Precedence facility. |
| Max Idle | Any valid setting |
| Call Retry | Any valid setting |
| Flow Facility | Set to on if you want to use a value other than the default window size and packet size configured in the BFE. |
| Window Size | Range is 2 to 7. If you want to use a value other than the default window size configured in the BFE, set Flow Facility to on. You must coordinate this value with the packet-level value. |
| Packet Size | Options include 128, 256, 512, and 1024. If you want to use a value other than the default packet size configured in the BFE, set Flow Facility to on.<br>(If the IP interface is configured to support multiple IP security levels, then set to 1024.) You must coordinate this value with the packet-level value. |
| Fast Select Request | Off |
| Fast Select Accept | Off |
| Reverse Charge Request | Off |
| Reverse Charge Accept | Off |
| User Facility | Null |
| DDN BFE | Enable |
| CUG Facility Format | None |

*(continued)*

**Table 11-2. BFE X.25 Network Service Record Parameter Settings** *(continued)*

| Parameter | Required Setting |
|---|---|
| CUG Facility Type | Parameter is ignored |
| CUG Number | Parameter is ignored |

# Chapter 12
# Configuring Network Address Translation

This chapter covers the following topics:


| Topic | Page |
|---|---|
| Overview of Network Address Translation | 12-2 |
| Customizing NAT Global Attributes | 12-8 |
| Customizing a NAT Interface | 12-15 |
| Configuring Static Translation | 12-17 |
| Configuring Dynamic Local Address Ranges | 12-19 |
| Configuring Dynamic Global Address Ranges | 12-22 |
| Configuring N-to-1 Address Translation | 12-25 |

# Overview of Network Address Translation

As corporate networks grow, they often use the Internet protocol without acquiring registered network addresses. This is acceptable as long as the network remains private. However, when access to the global Internet is required, conflicts often arise between private local addresses and global addresses registered to other users. While it is possible to restructure the local network, the job is difficult and costly, especially if there are “well-known” servers with links or references to each other. Network Address Translation (NAT) helps remedy the problem of unregistered IP addresses in IP networks.

You can configure three types of network address translation:

- Static -- Assigns a permanent “well-known” registered address to a specific private “unregistered” host address for a one-to-one map.
- Dynamic -- Assigns address translation on an as-needed basis. NAT software recycles dynamically mapped addresses after a timeout period that you configure.
- N-to-1 -- Assigns a range of local IP addresses to a single global IP address.

## Dynamic Address Translation

Using NAT, you can create a pool of registered IP network addresses, and remap your current addresses to addresses allocated from this pool when establishing a connection outside your company’s private or local network. The connection appears to the host or server on the Internet as if it is from the registered address space.

For example, company A, which uses a nonregistered IP addressing scheme within its network environment, needs to access resources in company B’s network. company B is located in a different network on the Internet. In this environment, NAT enables communications between the networks of company A and company B without requiring either company to restructure its existing network.

For example, a host sends an outbound packet from inside company A to company B. The packet follows normal IP routing to the NAT border router at the egress point in company A. When the NAT interface receives the packet, NAT software extracts the source address and compares it to an internal table of existing address translations. If the inside host's source address does not appear in the translation table, NAT software does the following:

1. Creates a new entry for the host
2. Assigns a globally unique IP number dynamically from a pool of available addresses
3. Changes the source address of the packet to the globally unique address

The router software then forwards the packet through the Internet to the NAT border router in company B.

When the packet arrives at company B, router software routes the packet to the destination local address within company B.

After a specified timeout period during which there have been no translated packets for a particular address translation, NAT software within company A removes the entry, freeing the global address for use by another inside host.

In Figure 12-1, a packet from company A's network with unregistered source address 10.0.0.15 is sent to a destination address in company B's network. The destination is a globally recognized registered address, 192.100.20.2.

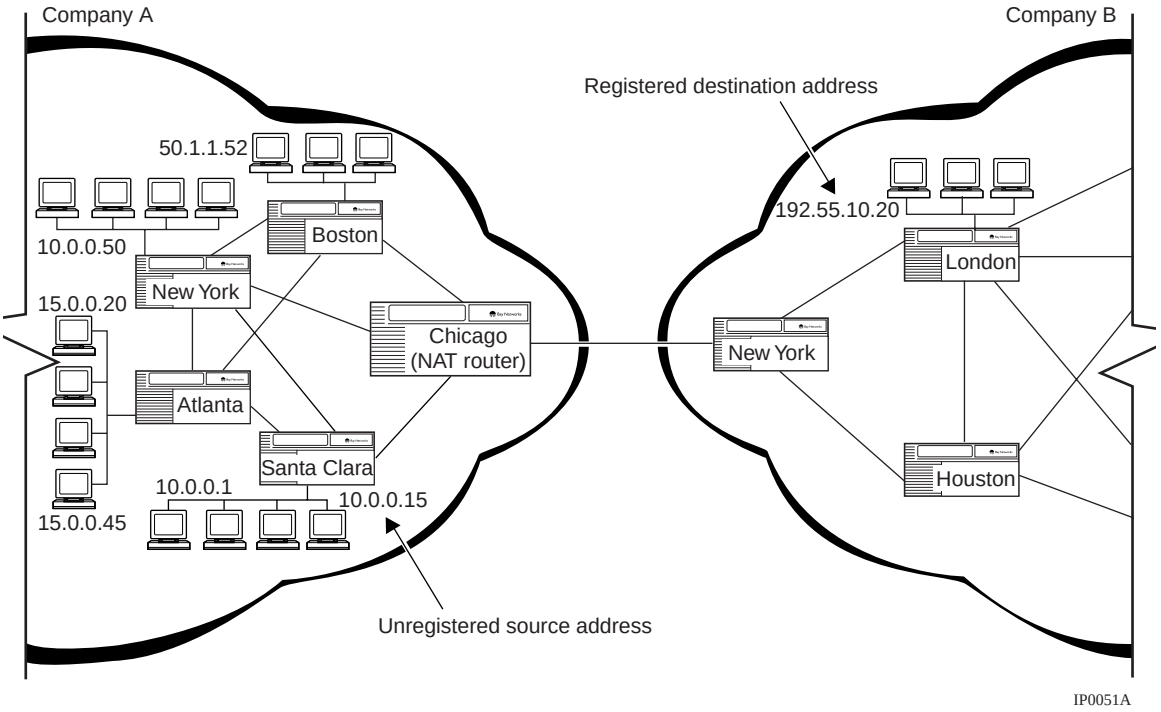


**Figure 12-1. Dynamic Translation Example**

The network administrator in company A has configured NAT to detect the following ranges of unregistered local addresses:

- 10.0.0.0 to 10.255.255.255
- 15.0.0.0 to 15.255.255.255
- 50.1.1.0 to 50.1.1.255

The network administrator has also configured the following ranges of registered global addresses:

- 192.55.10.0 to 192.55.10.255
- 192.20.10.0 to 192.20.10.255

NAT software detects a packet on a NAT interface that contains the address 10.0.0.15 (Figure 12-2).

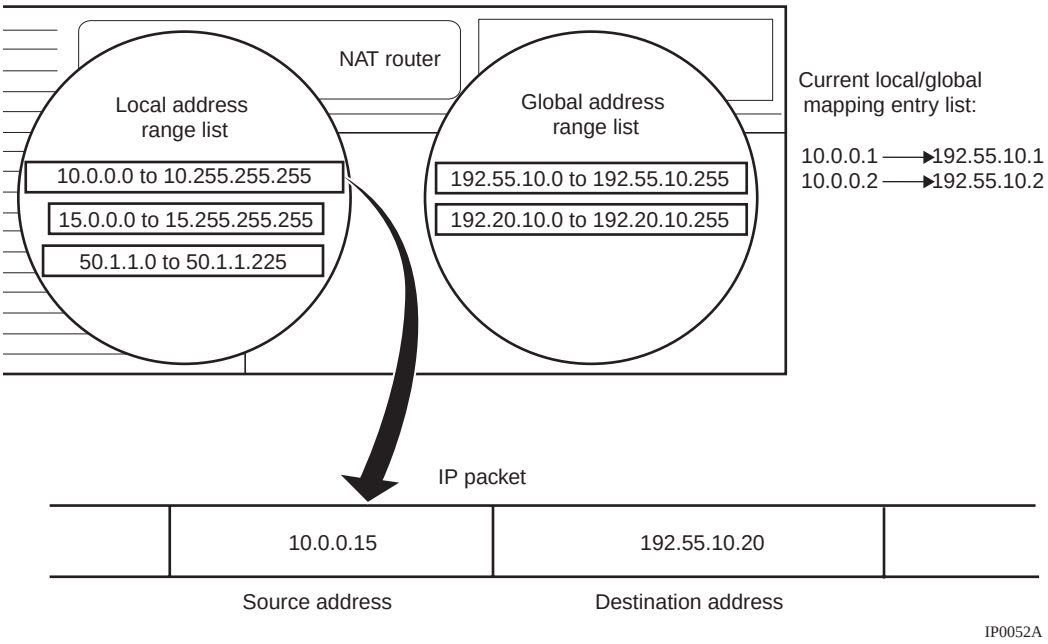


**Figure 12-2. NAT Detects the Unregistered Source Address**

NAT software dynamically translates the unregistered source address, 10.0.0.15, to one of the available registered global addresses (in this case, 192.55.10.3) and puts a new entry in the local/global translation entry list (Figure 12-3).

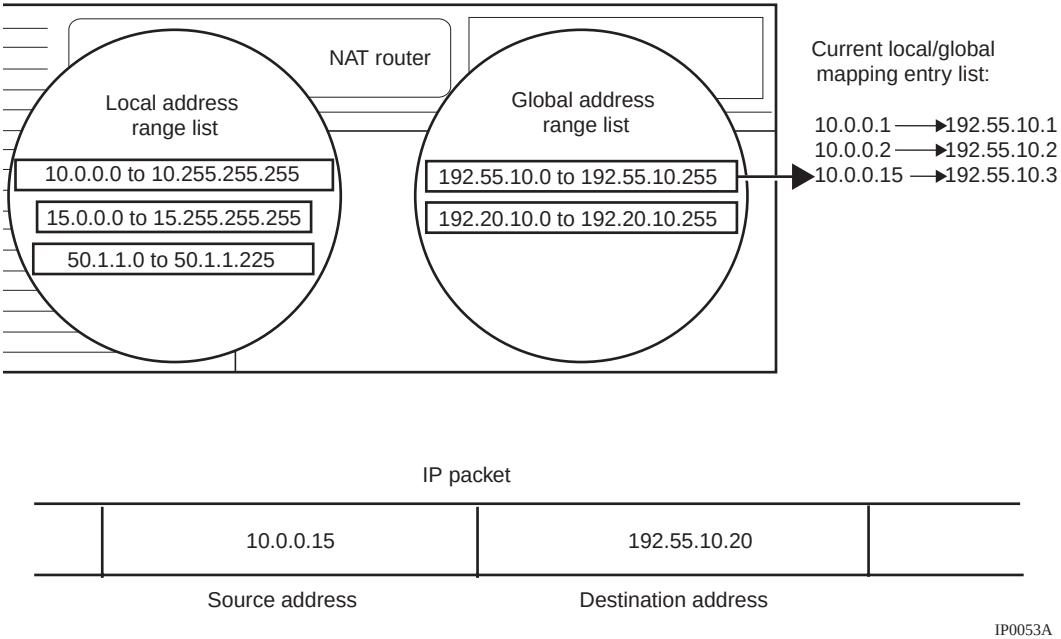


**Figure 12-3. NAT Updates the Local/Global Translation Entry List**

NAT software also replaces the unregistered local source address (10.0.0.15) with the translated global address (192.55.10.3) and sends the packet on its way to its destination in company B's network (Figure 12-4).

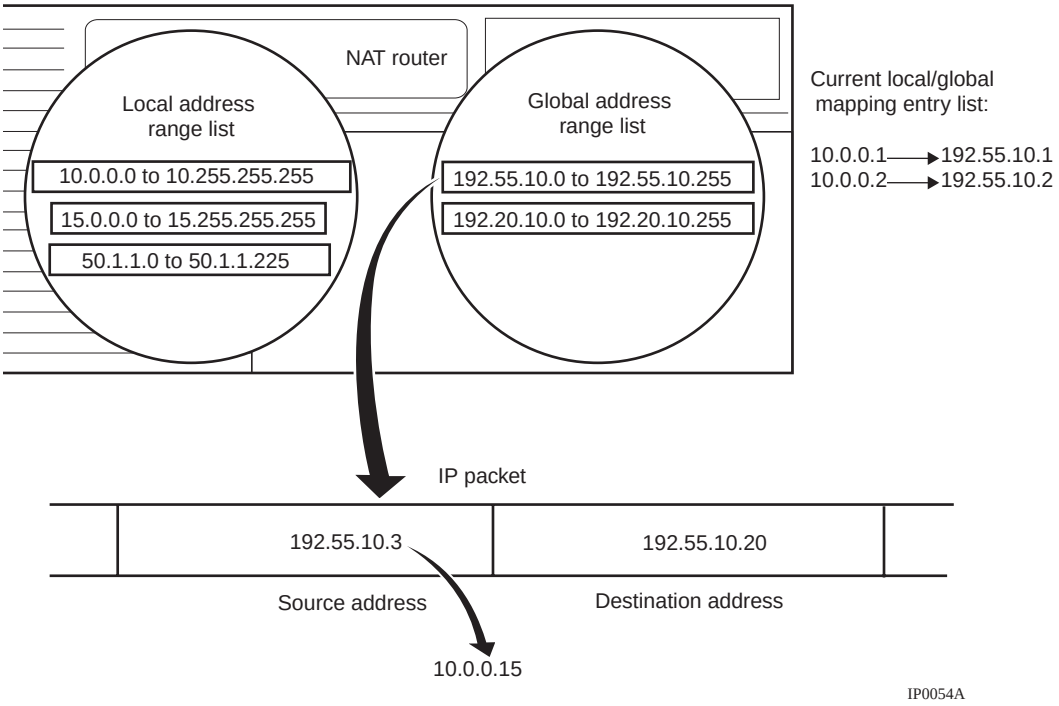


**Figure 12-4. NAT Replaces the Unregistered Local Address with a Registered Source Address**

## Static Address Translation

You can create a one-to-one translation of an unregistered local host address to a global address. This is referred to as *static address translation.*

Static address translation does not time out during periods when there is no traffic on the interface. The translation remains configured until you disable it.

# Customizing NAT Global Attributes

When you add NAT to an IP interface, NAT is enabled on a router with default values for all global attributes. Table 12-1 shows the default attributes.

**Table 12-1. Default Values for NAT Global Attributes**

| Attribute | Default |
|---|---|
| Enable | Enable |
| Soloist Slot Mask | All slots available to run as a soloist |
| Log Mask | All message types are logged (see "Configuring the Log Mask" on page 12-11 for a list of log message types). |
| Mapping Entry Timeout | Enable |
| Max Timeout | 3600 seconds |

To customize the way NAT operates on a router, modify NAT global attributes as described under the following sections:


| Topic | Page |
|---|---|
| Enabling and Disabling NAT | 12-9 |
| Configuring the Soloist Slot Mask | 12-10 |
| Configuring the Log Mask | 12-11 |
| Enabling and Disabling the Translation Entry Timeout Value | 12-13 |
| Configuring the Max Timeout Value | 12-14 |

## Enabling and Disabling NAT

To enable or disable NAT on an IP interface, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Global**. | The NAT Base Group Record window opens. |
| 5. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-99. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

Enabling NAT alone will not initiate address translation. You must also enable translation.

NAT can perform either or both of the following types of address translation:

- Static address translation
- Dynamic address translation

Static translation creates a one-to-one translation of an unregistered local host address to a global address. If you want to preserve a translation entry, use static translation. Static address translation does not time out during periods when there is no traffic on the interface. The translation remains configured until you disable it.

Dynamic translation creates a temporary mapping of an unregistered address to a global address. NAT software selects a global address from one or more global address pools that you configure, and maps this address to the unregistered address. If you enabled the Mapping Entry Timeout parameter, the mapping remains configured for the time you specify in the Max Timeout parameter. Otherwise, the mapping remains configured until you disable it.

For instructions on how to create and enable static translation, refer to "Configuring Static Translation" on page 12-17.

For instructions on how to create and enable dynamic translation, see the following sections: "Configuring Dynamic Local Address Ranges" on page 12-19 and "Configuring Dynamic Global Address Ranges" on page 12-22.

## Configuring the Soloist Slot Mask

To specify the slots on which NAT can run as a soloist, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Global**. | The NAT Base Group Record window opens. |
| 5. Choose **Soloist Slot Mask**. | |
| 6. Click on the **Values** button. | Site Manager displays a list of slots. |
| 7. Choose the slots you want to specify as available to run as a soloist. Click on **Help** or see the parameter description on page A-99. | Site Manager displays the binary values that correspond to your slot selections in the Soloist Slot Mask field.<br><br>For example, if a router has five slots, and you choose Slots 3 and 5, the binary value 00101 appears in the Soloist Slot Mask field. The leftmost bit represents the slot with the lowest number. |
| 8. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring the Log Mask

Table 12-2 shows messages types that are logged by NAT software and their respective bit positions (bit position 0 is the rightmost bit). If you change the log mask, the change takes effect immediately (if there are any messages to be logged).

**Table 12-2. Log Message Types**

| Message Type | Bit Position |
|---|---|
| NAT_DBG_FWD_GATE_MSG | 0 |
| NAT_DBG_MAPPING_ACTIONS | 1 |
| NAT_DBG_RANGE_ACTIONS | 2 |
| NAT_DBG_DATA_REQ_REPLY | 3 |
| NAT_DBG_MAP_TBL_REQ_REPLY | 4 |
| NAT_DBG_FTP_SESS_MSG | 5 |
| NAT_DBG_MIB_BASE_REC | 6 |
| NAT_DBG_MIB_RANGE_RECS | 7 |
| NAT_DBG_MIB_MAP_RECS | 8 |
| NAT_DBG_MIB_INTF_RECS | 9 |
| NAT_DBG_FILTER_ACTIONS | 10 |
| NAT_DBG_GATE_MAPPINGS | 11 |
| NAT_DBG_GATE_START_STOP | 12 |
| NAT_DBG_FWD_LOCAL_RX | 13 |
| NAT_DBG_FWD_GLOBAL_RX | 14 |
| NAT_DBG_FWD_XLATE | 15 |
| NAT_DBG_FWD_ERROR | 16 |
| NAT_DBG_FWD_FRAG | 17 |
| NAT_DBG_FWD_TCP | 18 |
| NAT_DBG_FWD_FTP_PORT | 19 |
| NAT_DBG_FWD_FTP_SESSION | 20 |
| NAT_DBG_FWD_ICMP | 21 |
| NAT_DBG_FWD_UDP | 22 |
| NAT_DBG_FWD_DROP | 23 |

*(continued)*

**Table 12-2. Log Message Types** *(continued)*

| Message Type | Bit Position |
|---|---|
| NAT_DBG_AGING_ACTIONS | 24 |
| NAT_DBG_ROUTE_ACTIONS | 25 |
| NAT_DBG_SESSION_AGING | 26 |
| Reserved | 27 to 32 |

To specify the types of log messages that are reported by NAT software, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Global**. | The NAT Base Group Record window opens. |
| 5. Set the **Log Mask** parameter. Click on **Help** or see the parameter description on page A-99. | |
| 6. Click on the **Values** button. | Site Manager displays a list of log message types. |
| 7. Choose the log message types that you want to be logged. | Site Manager displays the binary values that correspond to your log message type selections in the Log Mask field. |
| 8. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Enabling and Disabling the Translation Entry Timeout Value

You can configure a global timeout period for dynamic translation entries. If there have been no translated packets for a specific address mapping when the timer expires, NAT software removes the entry from the dynamic translation entry list, thus freeing the global address for another mapping.

To enable or disable this feature for a specific dynamic translation entry, proceed as follows:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Global**. | The NAT Base Group Record window opens. |
| 5. Set the **Mapping Entry Timeout** parameter. Click on **Help** or see the parameter description on page A-100. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Configuring the Max Timeout Value

You can configure the Max Timeout parameter to specify the timeout period for a dynamic translation entry. When the timer expires, NAT software removes the entry from the dynamic entry list.

Bay Networks recommends the default timeout period of 3600 seconds. If you set the timeout period too low, the timer will expire before NAT software can process the next packet. Valid values for the timeout period are in the range from 0 to 2,147,483,648 ($2^{31}$) seconds.

To can configure the timeout period for a dynamic translation entry, proceed as follows:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Global**. | The NAT Base Group Record window opens. |
| 5. Set the **Max Timeout** parameter. Click on **Help** or see the parameter description on page A-100. | |
| 6. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

# Customizing a NAT Interface

This section covers the following topics:


| Topic | Page |
|---|---|
| Enabling or Disabling NAT on an Interface | 12-15 |
| Modifying the Interface Type | 12-16 |


## Enabling or Disabling NAT on an Interface

To enable or disable NAT on a specific interface, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Interface** | The NAT Interface List window opens. |
| 5. Highlight the interface you want to enable from the list of IP interfaces. | |
| 6. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-100. | |
| 7. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

## Modifying the Interface Type

NAT software processes traffic received from an internal host on a NAT interface that you have configured as *local* and makes the necessary address translation.

NAT software sends the packet to an external network that you have configured as *global*.

To modify the interface type, proceed as follows:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Interface**. | The NAT Interface List window opens. |
| 5. Highlight the interface you want to modify from the list of IP interfaces. | |
| 6. Set the **Interface Type** parameter. Click on **Help** or see the parameter description on page A-101. | |
| 7. Click on **OK**. | Site Manager returns you to the Configuration Manager window. |

# Configuring Static Translation

Use Site Manager to create a one-to-one mapping of an unregistered local host address to a global address.

If you want to preserve a mapping, use static translation. A statically translated address does not time out during periods when there is no traffic on the interface. The mapping remains configured until you disable it.

The *local address* is an unregistered local address of a host in your network.

The *global address* is the registered source address you want to map to the local address.

## Adding Static Translation to Local and Global Interfaces

To assign static translation to a local and global address pair, proceed as follows:

| **Site Manager Path** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Static**. | The NAT Static Mapping List window opens. |
| 5. Click on the **Add** button. | The NAT Static Mapping Add window opens. |
| 6. Enter a local address. | |
| 7. Enter a global address. | |
| 8. Click on **OK**. | The static mapping pair appears in the list of current mapping pairs. |

## Enabling and Disabling Static Address Translation

To change the state of NAT static address translation, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Static**. | The NAT Static Mapping List window opens. |
| 5. Highlight the interface you want to modify from the list of IP interfaces. | |
| 6. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-101. | |
| 7. Click on **OK**. | NAT is enabled for the selected mapping pair. |

# Configuring Dynamic Local Address Ranges

Use Site Manager to add, delete, or change the state of dynamic local address ranges.

## Adding a Local Address Range

The local address range is a range of local unregistered source addresses. When NAT software detects a packet with one of these source addresses on a NAT local interface, it maps the local address to a registered global address, replaces the local address with the global address, and sends the packet to its destination address in another network.

You specify the base address and a prefix (from 0 to 32 decimal) to designate the range of addresses.

To add a local address range to the NAT Local Address Range List, proceed as follows:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Dynamic**. | The Local/Global menu opens. |
| 5. Choose **Local.** | The NAT Local Address Range List window opens. |
| 6. Click on the **ADD** button. | The NAT Local Address Range Add window opens. |
| 7. Enter a local base address. | |
| 8. Enter a prefix that designates the address range (0 to 32 decimal). | |
| 9. Click on **OK**. | The address range appears in the NAT Local Address Range List. |

## Deleting a Local Address Range

To delete a local address range, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Dynamic**. | The Local/Global menu opens. |
| 5. Choose **Local.** | The NAT Local Address Range List window opens. |
| 6. Click on a local address range. | The local address range is highlighted. |
| 7. Click on the **Delete** button. | |
| 8. Click on **OK**. | The address range disappears from the NAT Local Address Range List. |

## Enabling or Disabling a Local Address Range

To disable a local address range, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Dynamic**. | The Local/Global menu opens. |
| 5. Choose **Local.** | The NAT Local Address Range List window opens. |
| 6. Click on a local address range. | The local address range is highlighted. |
| 7. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-102. | |
| 8. Click on **OK**. | The address range is enabled. |

# Configuring Dynamic Global Address Ranges

Use Site Manager to add, delete, or change the state of global address ranges.

## Adding a Global Address Range

The global address range is a group of registered source addresses that you specify. NAT maps these addresses to an unregistered local address, replaces the local address with the global address, and sends the packet to its destination address in another network.

You specify the base address and a prefix (from 0 to 32 decimal) to designate the range of addresses.

To add a global address range to the NAT Global Address Range List, proceed as follows:

| **Site Manager Procedure** | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Dynamic**. | The Local/Global menu opens. |
| 5. Choose **Global.** | The NAT Global Address Range List window opens. |
| 6. Click on the **ADD** button. | |
| 7. Enter a global base address. | The NAT Global Address Range Add window opens. |
| 8. Enter a prefix that designates the address range (0 to 32 decimal). | |
| 9. Click on **OK**. | The address range appears in the NAT Global Address Range List. |

## Deleting a Global Address Range

To delete a global address range, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Dynamic**. | The Local/Global menu opens. |
| 5. Choose **Global**. | The NAT Global Address Range List window opens. |
| 6. Click on a global address range. | The global address range is highlighted. |
| 7. Click on the **Delete** button. | |
| 8. Click on **OK**. | The address range disappears from the NAT Global Address Range List. |

## Enabling or Disabling a Global Address Range

To change the state of a global address range, proceed as follows:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Dynamic**. | The Local/Global menu opens. |
| 5. Choose **Global**. | The NAT Global Address Range List window opens. |
| 6. Click on a global address range. | The global address range is highlighted. |
| 7. Set the **Enable** parameter. Click on **Help** or see the parameter description on page A-103. | |
| 8. Click on **OK**. | The address range is enabled. |

# Configuring N-to-1 Address Translation

*N-to-1 address translation* -- also known as dynamic port translation -- allows you to translate a range of local IP addresses on a private network into a single global IP address.

N-to-1 translation is valid only for TCP/UDP packets. All non-TCP/UDP packets with addresses that fall within the N-to-1 range are dropped.

With N-to-1 address translation enabled, you define a range of local addresses for N-to-1 translation and specify a single N-to-1 global address. When NAT receives a packet on the local interface, the following events occur:

1. NAT determines that the local source address falls within an N-to-1 range.
2. NAT assigns the N-to-1 global source address and a unique port number to the packet.
3. NAT transmits the packet on the global interface.

In Figure 12-5, for example, the network administrator has set up an N-to-1 local address range of 55.0.0.0 to 55.255.255.255 and associated this range of local addresses with global IP address 192.1.1.1. The following events occur:

1. NAT receives a packet from host A on the local interface with a local source address of 55.0.0.1 and a port number of 2001.
2. Determining that the local source address falls within an N-to-1 range, NAT stores the port number, replaces the local source address with the global address 192.1.1.1, assigns a new unique port number X12Y, and transmits the packet on the global interface.
3. Subsequently NAT receives a packet from host B on the local interface with local source address 55.0.0.2 and port number 2222. Determining that this local source address falls in the same N-to-1 range, NAT replaces the local source address with the global address 192.1.1.1, assigns unique port number X54Y, and transmits the packet on the global interface.

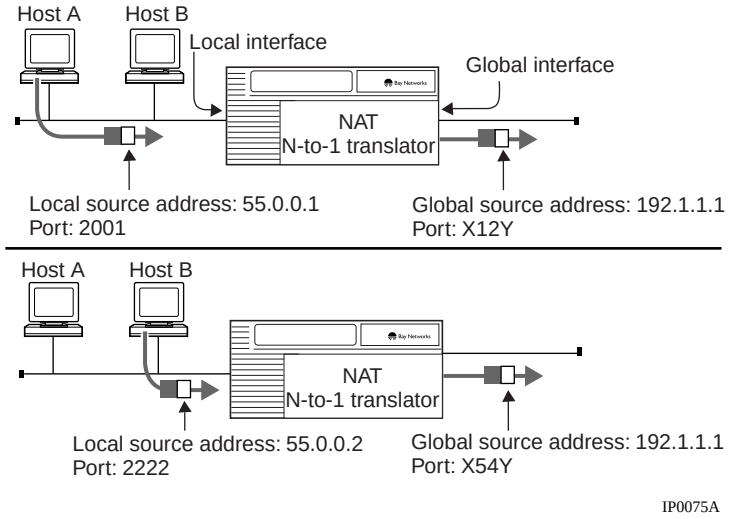


**Figure 12-5. N-to-1 Address Translation (Local to Global)**

When NAT receives a packet from a remote source on the global interface, the following events occur:

1. NAT determines that the destination address on the packet is a global N-to-1 address.
2. NAT uses the address and the port number to identify the destination host.
3. NAT attaches the local IP address to the packet and transmits it on the local interface.

In Figure 12-6, for example, the following events occur:

1. NAT receives a packet on the global interface with the destination address 192.1.1.1 and port number X12Y.
2. Determining that the destination address is an N-to-1 address, NAT uses the address and the port number to locate the destination host -- host A. NAT attaches the local address to the packet and transmits the packet on the local interface.
3. Subsequently, NAT receives a packet on the global interface with the destination address 192.1.1.1 and port number X54Y.

4. Determining that the destination address is an N-to-1 address, NAT uses the address and the port number to locate the destination host -- host B. NAT attaches the local address to the packet and transmits the packet on the local interface**.**

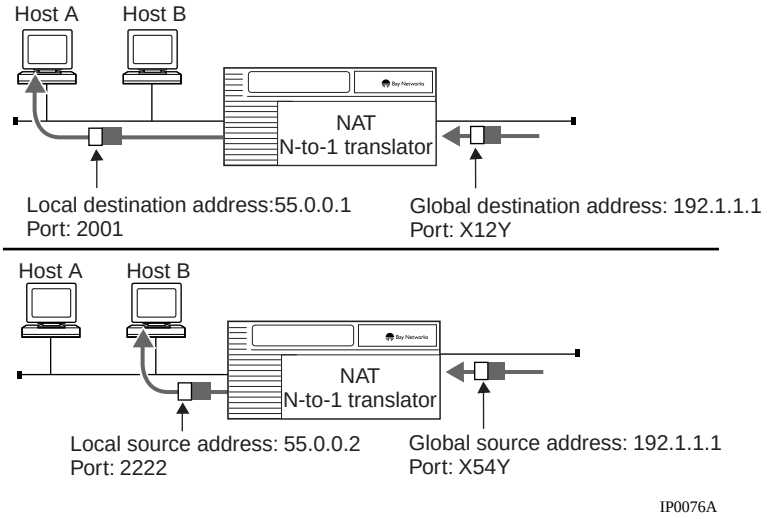


**Figure 12-6. N-to-1 Address Translation (Global to Local)**

To configure N-to-1 address translation, you perform the following operations:

1. **Define a local address range as described in "Adding a Local Address Range" on page 12-19.**
2. **Enable N-to-1 address translation.**
3. **Specify a global IP address.**

Use the following Site Manager procedure to enable N-to-1 translation and specify a global IP address.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **NAT**. | The NAT menu opens. |
| 4. Choose **Dynamic**. | The Local/Global menu opens. |
| 5. Choose **Local.** | The NAT Local Address Range List window opens. |
| 6. Click on a local address range. | The local address range is highlighted. |
| 7. Set the **N to 1 Address** parameter. Click on **Help** or see the parameter description on page A-102. | |
| 8. Click on **OK**. | The address range is configured for N-to-1 translation. |

# Chapter 13
# Generic Routing Encapsulation Tunnel

You create a Generic Routing Encapsulation (GRE) tunnel by setting GRE parameters as described under the following topics:


| Topic | Page |
|---|---|
| GRE Overview | 13-1 |
| How GRE Tunneling Works | 13-2 |
| Avoiding Tunnel Misconfiguration | 13-3 |
| Configuring a Generic Routing Encapsulation Tunnel | 13-6 |
| Adding and Deleting Protocols for GRE Tunnels | 13-6 |
| Configuring a Remote Tunnel End Point | 13-8 |
| Deleting a GRE Tunnel | 13-11 |


## GRE Overview

GRE, which is defined in RFCs 1701 and 1702, is a protocol that encapsulates IP and other layer 3 protocols enabling data transmission through an IP tunnel. This tunneling mechanism allows:

- Transport of non-IP traffic through intermediate systems that support only IP
- Creation of a virtual private network (VPN) that uses the Internet as a section of your own private network
- Communication between subnetworks with unregistered or discontiguous network addresses

When using GRE, remember that:

- This protocol is slower than native routing because packets require additional processing.
- IP fragmentation of the packet can occur due to extra bytes introduced by encapsulation.
- Troubleshooting the physical link when problems occur is difficult.

## How GRE Tunneling Works

You configure a GRE tunnel manually, assigning it a unique name. The source address is the IP address of an interface on the router on which you are configuring the GRE tunnel, and the destination address is the IP address of an interface on the router where the tunnel terminates.

The GRE tunnel can use any IP interface configured on the router as a physical end point. To maximize the robustness of the tunnel, use a circuitless IP address as a tunnel's physical end point whenever possible (see "Using the Circuitless IP Interface" on page 3-16).

The following steps explain how GRE tunneling takes place (refer to Figure 13-1):

1. The router interface on router 1 receives a packet from host 1, looks up the packet's destination address in its routing table, and determines that the next hop to the destination address is the remote end of a GRE tunnel. The router interface places the packet in the queue of the tunnel interface for GRE encapsulation.
2. The tunnel interface router 1 adds a GRE header to the packet and sends the packet to IP.
3. IP looks up the route to the remote tunnel end point and sends the GRE-encapsulated packet to the appropriate next-hop address.
4. The remote tunnel interface on router 2 removes the outer IP header and the GRE header.
5. The remote router interface looks up the packet's destination address in its routing table, and chooses the next hop to reach host 2.

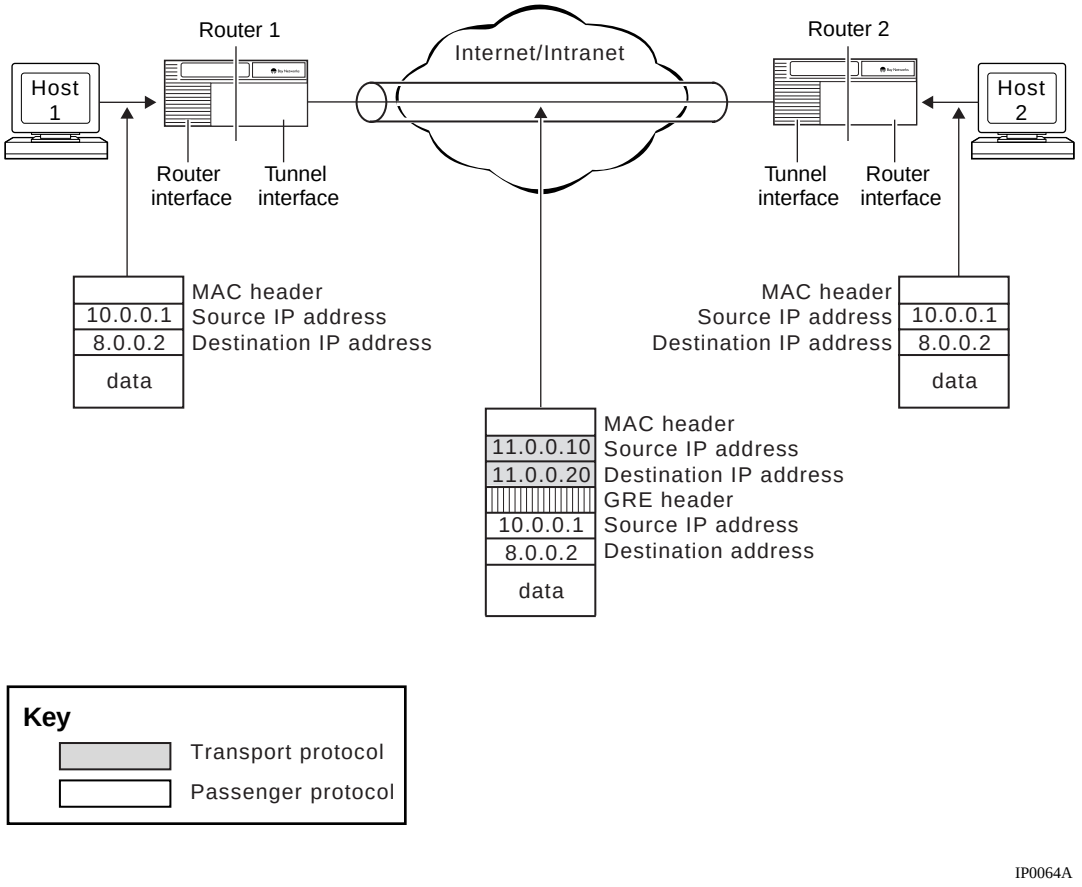


**Figure 13-1. GRE Tunneling**

# Avoiding Tunnel Misconfiguration

Before configuring a tunnel, you should be aware of a limitation inherent in the use of all tunnels, including GRE tunnels. A tunnel is a virtual point-to-point connection between two routers that are actually several hops apart. This point-to-point connection can hide the real distance between the routers from portions of the network leading to unintended, suboptimal routing decisions, and, in some cases, to routing loops.

In particular, if a router at one end of a tunnel determines that the best route to the remote physical end point of the tunnel is through the tunnel itself, a loop, internal to the router, occurs and prevents the tunnel from operating. You must configure one of the following at each end of the tunnel to prevent routing loops:

- Announce policy
- Accept policy
- Static route

The best choice depends on the network topology to which it is applied.

**Note:** You must implement an announce or accept policy or a static route at each end of the tunnel for the tunnel to operate correctly.

## Announce Policy

An announce policy governs the advertisement of routing information. When preparing a routing advertisement, IP consults its announce policies to determine whether or not to advertise the route (see “IP Routing Policies and Filters” on page 1-14).

For GRE tunneling, you configure an announce policy for each routing protocol (RIP, OSPF, BGP) configured on the logical tunnel interface to block the advertisement of a range of network addresses that contains the tunnel’s local physical interface address. To configure an announce policy for RIP, see “Configuring RIP Accept and Announce Policies” on page 6-29. To configure an announce policy for OSPF, see “Configuring OSPF Accept and Announce Policies” on page 7-58. To configure an announce policy for BGP, see “Configuring BGP Accept and Announce Policies” on page 8-63.

The disadvantage of using an announce policy is that it prevents the advertisement of other subnets within the blocked range. Depending on the network topology, this configuration may not be desirable.

## Accept Policy

An accept policy governs the addition of new routes to the routing tables (see “IP Routing Policies and Filters” on page 1-14). For GRE tunneling, you configure an accept policy for each routing protocol (RIP, OSPF, BGP) configured on the logical tunnel interface to block the receipt of advertisements a range of network addresses that contains the tunnel’s remote physical interface address.

To configure an accept policy for RIP, see “Configuring RIP Accept and Announce Policies” on page 6-29. To configure an accept policy for OSPF, see “Configuring OSPF Accept and Announce Policies” on page 7-58. To configure an accept policy for BGP, see “Configuring BGP Accept and Announce Policies” on page 8-63.

The disadvantage of using an accept policy is that it prevents the receipt of advertisements of subnets contained in the blocked range. Depending on the network topology, this configuration may not be desirable.

## Static Routes

A static route is a route configuration that designates a specific router within the intervening network cloud as the next hop to the remote physical tunnel end point. Because static routes take precedence over routes that the router learns dynamically from routing protocols, this configuration forces the router to direct packets through the cloud to reach the tunnel’s remote physical address.

The disadvantage of using a static route is that it is fixed. If the path through the chosen next hop to the remote tunnel end point goes down, the tunnel goes down as well until you manually reconfigure the static route. Similarly, even if the path through the chosen next hop becomes more costly than the path through some other attached router, the tunnel continues to use the costlier path unless you manually intervene.

**Note:** When configuring a static route, be careful not to inadvertently create a loop.

# Configuring a Generic Routing Encapsulation Tunnel

You can configure up to 64 GRE tunnels on one router; each GRE tunnel can have multiple end points. You can configure up to 256 remote tunnel end points distributed over the configured GRE tunnels.

To configure a GRE tunnel, complete the following tasks:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **GRE**. | The GRE Create Tunnels List window opens. |
| 4. Click on **Add Tunnel**. | The Create GRE Tunnel window opens. |
| 5. Set the following parameters:<br>• **IP Interface**<br>• **Tunnel Name**<br>Click on **Help** or see the parameter descriptions beginning on page A-104. | |
| 6. Click on **OK**. | You return to the GRE Create Tunnels List window. |
| 7. Go to the next section to add a protocol for the GRE tunnel you just configured. | |

# Adding and Deleting Protocols for GRE Tunnels

The Bay Networks implementation of GRE tunneling supports IP and IPX traffic encapsulated in IP. You can use Site Manager to add or delete a protocol for a GRE tunnel.

**Note:** Configuration of OSPF on both the physical and logical interfaces of a GRE tunnel is not supported.

## Adding a Protocol for a GRE Tunnel

To add a protocol for a GRE tunnel, complete the following tasks:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **GRE**. | The GRE menu opens. |
| 4. Choose a tunnel from the list and click on **Add/Del Prot**. | The Select Protocols window opens. |
| 5. Choose one or more protocols from the list and click on **OK**. | The appropriate configuration windows open. |
| 6. For instructions on configuring IP, RIP, BGP, and OSPF, see Chapter 3. For instructions on configuring IPX, see *Configuring IPX Services*. | You return to the GRE Create Tunnels List window. |
| 7. Click on **Done**. | You return to the Configuration Manager window. |

**Note:** When configuring OSPF on a GRE tunnel, Bay Networks recommends that you disable MTU mismatch detection. Failure to do this may prevent an OSPF adjacency from being formed over the tunnel.

## Deleting a Protocol from a GRE Tunnel

To delete a protocol from a GRE tunnel, complete the following tasks:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **GRE**. | The GRE Create Tunnels List window opens. |
| 4. Choose a tunnel from the list and click on **Add/Del Prot**. | The Select Protocols window opens. |
| 5. Click on the protocols that you want to delete, then click on **OK**. | The protocols no longer appear next to the tunnel name in the GRE Create Tunnels List window. |
| 6. Click on **Done**. | You return to the Configuration Manager window. |

# Configuring a Remote Tunnel End Point

A *remote tunnel end point* can be any IP interface configured on a Bay Networks router or another RFC 1701/1702 compliant router. To maximize the robustness of the tunnel, use a circuitless IP address as a tunnel's physical end point whenever possible (see "Using the Circuitless IP Interface" on page 3-16). Because a circuitless IP address is associated with the whole router, not one physical interface, the tunnel operates as long as any slot that has a working IP interface stays up.

To configure a remote tunnel end point, complete the following tasks.

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **GRE**. | The GRE Create Tunnels List window opens. |
| 4. Choose a tunnel from the list and click on **Remote Conn**. | The GRE Remote Connections List window opens. |
| 5. Click on **Add**. | The Create GRE Remote Connection window opens. |
| 6. Set the following parameters:<br>• **Connection Name**<br>• **Remote Physical IP Address**<br>• **Remote Logical IP Address**<br>• **Remote Logical IPX Address (hex)**<br>Click on **Help** or see the parameter descriptions beginning on page A-105. | |
| 7. Click on **OK**. | You return to the GRE Remote Connections List window. |
| 8. Click on **Done** until you return to the Configuration Manager window. | |

# Deleting a Remote Tunnel End Point

To delete a remote tunnel end point, complete the following tasks:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **GRE**. | The GRE Create Tunnels List window opens. |
| 4. Click on **Remote Conn**. | The GRE Remote Connections List window opens. |
| 5. Choose the remote tunnel end point that you want to delete and click on **Delete**. | A confirmation window opens. |
| 6. Click on **Yes**. | You return to the GRE Remote Connections List window. |
| 7. Click on **Done** until you return to the Configuration Manager window. | |

# Deleting a GRE Tunnel

You can use Site Manager to delete a GRE tunnel. To delete a GRE tunnel, complete the following tasks:

| Site Manager Procedure | |
|---|---|
| **You do this** | **System responds** |
| 1. In the Configuration Manager window, choose **Protocols**. | The Protocols menu opens. |
| 2. Choose **IP**. | The IP menu opens. |
| 3. Choose **GRE**. | The GRE Create Tunnels List window opens. |
| 4. Choose the tunnel that you want to delete and click on **Del Tunnel**. | A confirmation window opens. |
| 5. Click on **OK**. | The GRE Create Tunnels List window opens. |
| 6. Click on **Done**. | You return to the Configuration Manager window. |

# Appendix A
# Site Manager Parameters


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# BGP Parameters


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## BGP Configuration Parameters

**Parameter: Identifier**

Path: Choose BGP in the Select protocols window.

Default: None

Options: An IP address of an IP interface on this router

Function: Identifies the BGP router. There is no default for this parameter. You must use an IP address of one of the router's IP interfaces.

Instructions: Either accept the current BGP identifier or enter a new IP address. The BGP identifier must be one of the router's IP interfaces. If both BGP and OSPF are running on the router, then the OSPF router ID must be equivalent to one of the configured IP interfaces.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.4

**Parameter: Local AS**

Path: Select BGP in the Select protocols window.

Default: None

Options: 1 to 65,535

Function: Identifies the autonomous system to which this BGP router belongs.

Instructions: Enter a value from 1 to 65,535.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.5

## BGP Global Parameters

**Parameter: BGP Enable**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global

Default: Enable

Options: Enable | Disable

Function: Globally enables or disables BGP on all router interfaces.

Instructions: Set to Disable if you want to disable BGP for the entire router. Set to Enable if you previously disabled BGP and now want to reenable it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.2

**Parameter: BGP Identifier**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global
Default: None
Options: An IP address of an IP interface on this router
Function: Identifies the BGP router. There is no default for this parameter. You must use an IP address of one of the router's IP interfaces.
Instructions: Either accept the current BGP identifier or enter a new IP address. The BGP identifier must be one of the router's IP interfaces. If both BGP and OSPF are running on the router, then the OSPF router ID must be equivalent to one of the configured IP interfaces.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.4

**Parameter: BGP Local AS**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global
Default: None
Options: 1 to 65,535
Function: Identifies the autonomous system to which this BGP router belongs.
Instructions: Either accept the current BGP Local AS value or enter a new value for this parameter.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.5

**Parameter: BGP Intra-AS**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global
Default: Enable
Options: Enable │ Disable
Function: Specifies whether BGP will perform intra-AS IBGP routing.
Instructions: Transit ASs should use intra-AS routing. Stub or multihomed ASs usually do not use IBGP intra-AS routing.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.8

**Parameter: BGP From Protocols**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > BGP > BGP Global |
| Default: | BGP |
| Options: | BGP \| All |
| Function: | Controls (if intra-AS routing is enabled) the types of routes that BGP advertises in any IBGP sessions. |
| Instructions: | Select BGP to propagate only advertised routes learned from external BGP peers. Select All to propagate routes learned from all route sources (excluding IBGP and OSPF interarea and intra-area routes, which are never advertised with IBGP). |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.1.9 |

**Parameter: BGP Interval Timer**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > BGP > BGP Global |
| Default: | 5 seconds |
| Options: | 1 to 2,147,483,647 |
| Function: | Specifies the minimum time interval, in seconds, between injections of external BGP routes into the IP routing table. |
| Instructions: | Accept the default or enter a nonzero value. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.1.10 |

**Parameter:** **BGP Collision Detect**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global

Default: Enable

Options: Enable │ Disable

Function: Specifies whether redundant BGP connections to the same router will be detected and disallowed. If you want only one BGP connection to the same router to be maintained, use the default. If you want to allow redundant connections, enter Disable.

Instructions: Collision detection is based on router ID. If two BGP peers have multiple physical connections and want to establish a BGP session across each physical connection, you must disable this parameter. The advantage of a configuration with multiple physical connections is redundancy. The disadvantage is that such a configuration results in multiple copies of each route.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.16

**Parameter:** **Multi-hop EBGP Connection**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global

Default: Disable

Options: Enable │ Disable

Function: Specifies whether BGP allows multihop connections to an external BGP peer.

Instructions: By default, BGP enforces the rule that requires an external BGP peer to be located on a directly attached network. Use this parameter to override the restriction. Enabling multihop BGP connections is dangerous because it can cause BGP speakers to establish BGP connections that traverse a third-party AS, possibly violating policy considerations and introducing forwarding loops.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.6

**Parameter:** **BGP Dynamic Policy Change Support**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global

Default: Enable

Options: Enable │ Disable

Function: Specifies whether or not BGP dynamically reevaluates all routes affected by a policy when you modify the policy.

Instructions: Select disable if you want BGP to restart all connections when you modify a policy.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.19

**Parameter:** **BGP Soloist Slots**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global

Default: All slots

Options: Slots 1 to 14

Function: Specifies slots on which the BGP soloist is eligible to run.

Instructions: Use the ISP Mode parameter (IP global) to configure BGP as a soloist.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.20

**Parameter:** **Route Server Topology**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global

Default: None

Options: None │ Client │ Mesh │ Tree

Function: Configures BGP as an IBGP route server or client.

Instructions: If BGP is neither a client nor a server, use the default, None.

If you want BGP to establish a client-server connection to an IBGP route server, specify Client.

If you want BGP to establish a server-server connection to an IBGP route server in the same cluster, specify Mesh.

If you want BGP to establish a server-connection to an IBGP route server in another cluster, specify Tree.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.17

**Parameter: Cluster Identifier**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global
Default: Null
Options: 1 to 4,294,967,295
Function: Associates the IBGP route server with a cluster.
Instructions: If BGP is configured as an IBGP route server in a cluster, you must specify a cluster ID. All IBGP route servers in the same cluster must have the same cluster ID.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.18

**Parameter: Aggregate Subnets**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global
Default: Enable
Options: Enable │ Disable
Function: Specifies whether subnet routes from non-BGP sources are aggregated to their corresponding natural network routes for advertisement to BGP peers. Advertisement of BGP-originated routes is not affected by this switch.
Instructions: Set this parameter as required.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.22

**Parameter: Black Hole Routes**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global
Default: Disabled
Options: Disabled │ Drop │ Reject
Function: Specifies whether BGP submits a black-hole route into the routing table for an aggregate route advertised to a BGP peer.
Instructions: To drop a packet for an unknown destination, set this parameter to Drop. To configure BGP to return an ICMP destination unreachable message to the sender, set this parameter to Reject.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.23

**Parameter: Route with MED**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global
Default: Enabled
Options: Enabled │ Disabled
Function: Specifies whether BGP considers the Multi-Exit Discriminator attribute in the route selection process.
Instructions: Set this parameter as required.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.24

**Parameter: IBGP ECMP Method**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global
Default: Disabled
Options: Disabled │ Route Balance │ Traffic Balance
Function: Specifies whether IBGP uses ECMP paths provided by the IGP for route balancing or traffic-load balancing.
Instructions: To configure IBGP to use IGP ECMP routes for route balancing, set this parameter to Route Balance. To configure IBGP to use IGP ECMP routes for traffic-load balancing, set this parameter to Traffic Balance.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.26

**Parameter: Local Pref Calculation**

Path: Configuration Manager > Protocols > IP > BGP > BGP Global
Default: Enabled
Options: Enabled │ Disabled
Function: Disables BayRS local preference calculation of received EBGP routes.
Instructions: Set this parameter as required.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.1.27

## BGP-3 Global Parameter

| | |
|---|---|
| **Parameter:** | **Enable** |
| Path: | Configuration Manager > Protocols > IP > BGP > BGP-3 Global |
| Default: | Enable |
| Options: | Enable \| Disable |
| Function: | Globally enables or disables BGP-3 on all router interfaces. |
| Instructions: | Set to Disable if you want to disable BGP-3 for the entire router. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.2.1.2 |

## BGP-4 Global Parameter

| | |
|---|---|
| **Parameter:** | **Enable** |
| Path: | Configuration Manager > Protocols > IP > BGP > BGP-4 Global |
| Default: | Enable |
| Options: | Enable \| Disable |
| Function: | Globally enables or disables BGP-4 on all router interfaces. |
| Instructions: | Set to Disable if you want to disable BGP-4 for the entire router. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.3.1.2 |

## BGP Peer Parameters

| | |
|---|---|
| **Parameter:** | **Peer Address** |
| Path: | Configuration Manager > Protocols > IP > BGP > Peers |
| Default: | None |
| Options: | Any IP address |
| Function: | Specifies the IP address of the interface on the remote side of this BGP peer connection. |
| Instructions: | Enter the IP address in dotted-decimal notation. If the peer is in a remote AS, the address must be on the same subnet as the local interface. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.6 |

**Parameter: Peer AS**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > BGP > Peers |
| Default: | None |
| Options: | 1 to 65535 |
| Function: | Identifies the autonomous system to which the BGP router at the remote end of this BGP peer connection belongs. |
| Instructions: | Enter the appropriate AS number. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.10 |

**Parameter: Local Address**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > BGP > Peers |
| Default: | None |
| Options: | Any IP address |
| Function: | Specifies the IP address of the interface on the local side of this BGP peer connection. |
| Instructions: | Enter the appropriate address. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.4 |

**Parameter: Peer Mode**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > BGP > Peers |
| Default: | None |
| Options: | None \| Internal \| External |
| Function: | Indicates the route server mode of the remote BGP peer. |
| Instructions: | If the peer is a node, use the default, None.<br>If the peer is an RS client, specify Client.<br>If the peer is a route server in the same cluster, specify Internal.<br>If the peer is a route server in a different cluster, specify External. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.35 |

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > BGP > Peers
Default: Enable
Options: Enable │ Disable
Function: Enables or disables a BGP peer relationship with the specified IP address.
Instructions: Set this parameter to Disable if you want to temporarily disable this peer relationship rather than delete it. Or set it to Enable if you previously disabled this peer relationship and now want to reenable it.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.2

**Parameter: Min BGP Version**

Path: Configuration Manager > Protocols > IP > BGP > Peers
Default: 4
Options: 3 or 4
Function: Specifies the minimum acceptable BGP version to run on this peer connection.
Instructions: Specify BGP-3 or BGP-4.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.8

**Parameter: Max BGP Version**

Path: Configuration Manager > Protocols > IP > BGP > Peers
Default: 4
Options: 3 or 4
Function: Specifies the maximum acceptable BGP version to run on this peer connection.
Instructions: Specify BGP-3 or BGP-4.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.9

**Parameter: Peer AS**

Path: Configuration Manager > Protocols > IP > BGP > Peers
Default: None
Options: 1 to 65535
Function: Identifies the autonomous system to which the BGP router at the remote end of this BGP peer connection belongs.
Instructions: Either accept the current value or enter a new one.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.10

**Parameter: External Advertisement Timer**

Path: Configuration Manager > Protocols > IP > BGP > Peers
Default: 5 seconds
Options: 1 to 2,147,483,647
Function: Specifies the minimum number of seconds allowed between BGP updates for this peer connection.
Instructions: Either accept the current value or enter a value greater than 0 seconds.
MIB Object ID: The external advertisement interval controls how often the IP routing table is examined for changes. BGP update messages for routes that originate outside this AS will be issued no faster than the number of seconds you specify with this parameter.

**Parameter: Connect Retry Timer**

Path: Configuration Manager > Protocols > IP > BGP > Peers
Default: 120 seconds
Options: 0 to 2,147,483,647
Function: Specifies the maximum number of seconds allowed between TCP connection attempts for this peer connection.
Instructions: Either accept the current value or set this parameter to some other value. A value of 0 indicates that no active attempt to establish a BGP connection to the peer is to be done. Incoming calls from the peers will be accepted.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.12

**Parameter: Holdtime**

Path: Configuration Manager > Protocols > IP > BGP > Peers

Default: 90 seconds

Options: 0 or any decimal number greater than 2

Function: Specifies the holdtime that will be inserted into an open message. Upon receipt of the peer's open message, the lesser of the two holdtimes will be used (this must be at least 3 seconds). There are two exceptions. If one peer sends a zero holdtime, then the nonzero holdtime is used. If both peers send zero holdtimes, then no holdtime is used. The calculated holdtime is the amount of time either peer will wait for a keepalive or update message before declaring the connection down.

Instructions: Either accept the current Holdtime Timer value or set the parameter to 0 or some value greater than 2 seconds.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.13

**Parameter: Keepalive Timer**

Path: Configuration Manager > Protocols > IP > BGP > Peers

Default: 30 seconds

Options: Any decimal number

Function: Specifies how often keepalive messages will be sent across this peer connection.

Instructions: If a holdtime of 0 is negotiated, no periodic keepalive messages are sent. Otherwise, the Keepalive timer is set to the smaller of this configured value and one-third of the holdtime.

MIB Object ID: Either accept the current keepalive value or set this parameter to some value greater than 0.

**Parameter: Min AS Origination Interval**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > BGP > Peers |
| Default: | 15 seconds |
| Options: | A value greater than 0 |
| Function: | Determines the minimum amount of time that must elapse between successive advertisements of update messages that report changes within the advertising BGP speaker's own autonomous system. |
| Instructions: | Enter a value greater than 0 seconds. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.30 |

**Parameter: Local AS to Advertise to Peer**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > BGP > Peers |
| Default: | Null |
| Options: | 1 to 65535 |
| Function: | Specifies the AS number that is sent in an open message to this peer. |
| Instructions: | Enter an AS number. To specify the AS number you set with the BGP Local AS parameter, use the default, null. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.31 |

**Parameter: Peer Max Update Size**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > BGP > Peers |
| Default: | 800 bytes |
| Options: | 64 to 4096 |
| Function: | Specifies the maximum size (in bytes) of update messages that are sent to this peer. |
| Instructions: | Use the default or specify a size. Note that, if the size of the update message that advertises a single route is greater than the configured message size, the actual message size can exceed the configured value. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.32 |

**Parameter: Peer Route Echo Switch**

Path: Configuration Manager > Protocols > IP > BGP > Peers

Default: Enable

Options: Enable │ Disable

Function: Controls the way the router echoes a BGP route that is selected for forwarding. (Echoing in this case means advertising the route back to the peer from which it was received.) If this parameter is enabled, the router advertises the route back as reachable and includes the local AS. If this parameter is disabled, the router echoes the route as unreachable/withdrawn.

Instructions: If the peer router saves routes that contain its own AS number and is running short of memory, send an unreachable echo.

MIB Object ID: A BGP speaker that participates in inter-AS multicast routing must advertise a route it receives from one of its external peers. If the router stores the route in its routing table, it must also advertise it back to the peer from which the route was received. For a BGP speaker that does participate in inter-AS multicast routing, such echoing is optional.

**Parameter: Delayed Granularity**

Path: Configuration Manager > Protocols > IP > BGP > Peers

Default: 30 seconds

Options: 1 to 30

Function: Specifies the number of seconds a route server waits before accepting and serving routes to a client that another route server may have accepted.

Instructions: This parameter is a backoff timer that eliminates contention between route servers for clients. IBGP route servers in a cluster balance their client load. This value should be less than two-thirds of the smallest holdtime interval of all connections between route servers in the AS and their clients (including route servers in other clusters).

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.36

**Parameter: Loop Detection**

Path: Configuration Manager > Protocols > IP > BGP > Peers

Default: Enabled

Options: Enabled │ Disabled

Function: Specifies whether BGP terminates a peer-to-peer session if it discovers a loop in the AS path.

Instructions: Set this parameter as required.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.41

**Parameter: Peer EBGP ECMP**

Path: Configuration Manager > Protocols > IP > BGP > Peers

Default: Disabled

Options: Disabled │ Route Balance │ Traffic Balance

Function: Configures BGP to use ECMP routes in the routing table for route balancing or traffic-load balancing.

Instructions: To configure BGP to use ECMP routes for route balancing, set this parameter to Route Balance. To configure BGP to use ECMP routes for traffic-load balancing, set this parameter to Traffic Balance.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.42

**Parameter: TTL**

Path: Configuration Manager > Protocols > IP > BGP > Peers

Default: 0

Options: 0 to 255 hops

Function: Specifies the starting value of the time-to-live (TTL) counter in each packet sent to the remote peer. This parameter places a limit on the allowed distance (number of hops) to the remote peer.

For external BGP peers, this parameter is valid only if BGP is configured to allow multihop peer-to-peer sessions. If BGP does not allow multihop external peer-to-peer sessions, this parameter is set to 1 to enforce the one-hop rule.

Instructions: To set this parameter to the TTL value configured for global IP, use the default setting, 0.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.2.1.44

## BGP AS Weight and Weight Class Parameters

**Parameter: AS**

Path: Configuration Manager > Protocols > IP > BGP > Weights
Default: Null
Options: 1 to 65,535
Function: Identifies the autonomous system to which you want to assign a weight.
Instructions: Enter the appropriate AS number.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.3.1.4

**Parameter: Weight Value 1**

Path: Configuration Manager > Protocols > IP > BGP > Weights
Default: 8
Options: 1 to 15, plus the infinity value of 16
Function: Specifies the class 1 weight value to add to this AS. This weight value is added to the other AS weight values in a route to determine the preference of the route and aid in route selection.
Instructions: Either accept the current AS weight value or enter a new value. Any route that traverses an AS with an AS weight of 16 (infinity) will not be used.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.3.1.5

**Parameter: Weight Value 2**

Path: Configuration Manager > Protocols > IP > BGP > Weights
Default: 8
Options: 1 to 15, plus the infinity value of 16
Function: Specifies the class 2 weight value to add to this AS. This weight value is added to the other AS weight values in a route to determine the preference of the route and aid in route selection.
Instructions: Either accept the current AS weight value or enter a new value. Any route that traverses an AS with an AS weight of 16 (infinity) will not be used.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.3.1.5

**Parameter: Weight Value 3**

Path: Configuration Manager > Protocols > IP > BGP > Weights

Default: 8

Options: 1 to 15, plus the infinity value of 16

Function: Specifies the class 3 weight value to add to this AS. This weight value is added to the other AS weight values in a route to determine the preference of the route and aid in route selection.

Instructions: Either accept the current AS weight value or enter a new value. Any route that traverses an AS with an AS weight of 16 (infinity) will not be used.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.3.1.5

**Parameter: Weight Value 4**

Path: Configuration Manager > Protocols > IP > BGP > Weights

Default: 8

Options: 1 to 15, plus the infinity value of 16

Function: Specifies the class 4 weight value to add to this AS. This weight value is added to the other AS weight values in a route to determine the preference of the route and aid in route selection.

Instructions: Either accept the current AS weight value or enter a new value. Any route that traverses an AS with an AS weight of 16 (infinity) will not be used.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.3.1.5

**Parameter: Weight Value 5**

Path: Configuration Manager > Protocols > IP > BGP > Weights

Default: 8

Options: 1 to 15, plus the infinity value of 16

Function: Specifies the class 5 weight value to add to this AS. This weight value is added to the other AS weight values in a route to determine the preference of the route and aid in route selection.

Instructions: Either accept the current AS weight value or enter a new value. Any route that traverses an AS with an AS weight of 16 (infinity) will not be used.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.3.1.5

**Parameter: Weight Value 6**

Path: Configuration Manager > Protocols > IP > BGP > Weights

Default: 8

Options: 1 to 15, plus the infinity value of 16

Function: Specifies the class 6 weight value to add to this AS. This weight value is added to the other AS weight values in a route to determine the preference of the route and aid in route selection.

Instructions: Either accept the current AS weight value or enter a new value. Any route that traverses an AS with an AS weight of 16 (infinity) will not be used.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.3.1.5

**Parameter: Weight Value 7**

Path: Configuration Manager > Protocols > IP > BGP > Weights

Default: 8

Options: 1 to 15, plus the infinity value of 16

Function: Specifies the class 7 weight value to add to this AS. This weight value is added to the other AS weight values in a route to determine the preference of the route and aid in route selection.

Instructions: Either accept the current AS weight value or enter a new value. Any route that traverses an AS with an AS weight of 16 (infinity) will not be used.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.3.1.5

**Parameter: Weight Value 8**

Path: Configuration Manager > Protocols > IP > BGP > Weights

Default: 8

Options: 1 to 15, plus the infinity value of 16

Function: Specifies the class 8 weight value to add to this AS. This weight value is added to the other AS weight values in a route to determine the preference of the route and aid in route selection.

Instructions: Either accept the current AS weight value or enter a new value. Any route that traverses an AS with an AS weight of 16 (infinity) will not be used.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.3.1.5

**Parameter:** **Enable**

Path: Configuration Manager > Protocols > IP > BGP > Weights
Default: Enable
Options: Enable │ Disable
Function: Enables or disables a weight assignment for a particular AS.
Instructions: Set to Disable to disable the weight assignment for this AS; set to Enable if you previously disabled this weight assignment and now want to reenable it.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.3.1.2

## BGP Event Message Parameters

**Parameter:** **Local IP Address**

Path: Configuration Manager > Protocols > IP > BGP > Debug
Default: Null
Options: An IP address
Function: Specifies a BGP peer's local address.
Instructions: Enter 0.0.0.0. to obtain event messages about all connections to a peer with the specified local address.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.5.1.2

**Parameter:** **Remote Address**

Path: Configuration Manager > Protocols > IP > BGP > Debug
Default: Null
Options: An IP address
Function: Specifies a BGP peer's remote address.
Instructions: Enter 0.0.0.0 to obtain event messages about all connections to peers using the specified remote address.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.5.1.3

**Parameter:** **Message Level**

Path: Configuration Manager > Protocols > IP > BGP > Debug
Default: All
Options: All │ Debug │ Info │ Warning │ Fault │ Trace
Function: Specifies the severity level of event messages received.
Instructions: Select the default to obtain event messages of all levels.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.5.1.4

**Parameter:** **Message Trace Switch**

Path: Configuration Manager > Protocols > IP > BGP > Debug
Default: Disable
Options: Disable │ Open │ Update │ Notification │ Keepalive
Function: Specifies whether or not BGP messages on the specified connection are logged and, if so, which messages are logged.
Instructions: Use the default or select a BGP message type.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.5.1.5

## EGP Parameters


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## EGP Global Parameters

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > EGP

Default: Enable

Options: Enable | Disable

Function: This parameter allows you to globally enable or disable EGP on all router interfaces.

Instructions: Set to Disable if you want to disable EGP for the entire router. Set to Enable if you previously disabled EGP and now want to reenable it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.4.1.2

**Parameter: Local Autonomous System ID**

Path: Configuration Manager > Protocols > IP > EGP

Default: None

Options: 1 to 65,535

Function: Identifies the local autonomous system (the AS to which this router belongs) by the NIC-assigned decimal number. There is no default for this parameter.

Instructions: Either accept the current value for this parameter or enter a new value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.4.1.7

## EGP Neighbor Parameters

| | |
|---|---|
| **Parameter:** | **Remote Peer IP Address** |
| Path: | Configuration Manager > Protocols > IP > EGP > Neighbors |
| Default: | Null |
| Options: | Any IP address |
| Function: | Specifies the IP address of the remote router that will form an EGP neighbor relationship with this router. |
| Instructions: | Enter the IP address in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.4.3.1.4 |

| | |
|---|---|
| **Parameter:** | **Gateway Mode** |
| Path: | Configuration Manager > Protocols > IP > EGP > Neighbors |
| Default: | Core |
| Options: | Core \| Non Core |
| Function: | Specifies the gateway mode for this EGP neighbor. If you choose Core, the default, the local AS to which this EGP neighbor belongs will act as a transit AS. That is, it will advertise networks that reside within the AS as well as within external networks. |
| Instructions: | If you choose Non Core, the AS to which this EGP neighbor belongs will act as a stub AS. That is, it will advertise only networks that reside within the AS. Set this parameter to either Core or Non Core, depending on how you want this EGP neighbor to function. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.4.3.1.5 |

**Parameter:** **Enable**

Path: Configuration Manager > Protocols > IP > EGP > Neighbors

Default: Enable

Options: Enable │ Disable

Function: Enables or disables an EGP neighbor relationship with the specified IP address.

Instructions: Set this parameter to Disable if you want to temporarily disable this neighbor relationship rather than delete it. Or set it to Enable if you previously disabled this neighbor relationship, and now want to reenable it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.4.3.1.2

**Parameter:** **Acquisition Mode**

Path: Configuration Manager > Protocols > IP > EGP > Neighbors

Default: Passive

Options: Passive │ Active

Function: Specifies which of the two neighbors initiates EGP connections. The router in the active mode is the initiator.

Instructions: Set this parameter to Active if you want the local EGP neighbor to be the initiator of EGP connections. Otherwise, accept the default value, Passive.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.4.3.1.7

**Parameter:** **Poll Mode**

Path: Configuration Manager > Protocols > IP > EGP > Neighbors

Default: Both

Options: Active │ Passive │ Both

Function: Specifies the type of neighbor reachability algorithm this local EGP neighbor executes. In the active mode, a router sends hello and poll messages to request reachability status from its neighbor. In the passive mode, a router responds to hello and poll messages with I-H-U and update messages.

Instructions: Accept the default value, Both, or set to either Active or Passive (depending on the neighbor reachability algorithm you want this router to execute).

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.4.3.1.8

**Parameter: Hello Timer**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > EGP > Neighbors |
| Default: | 60 seconds |
| Options: | 30 to 120 seconds |
| Function: | Specifies the number of seconds between the local EGP neighbor's EGP Hello message retransmissions. This variable represents the RFC 904 T1 timer. |
| Instructions: | Accept the default value of 60 seconds for this parameter or set it to some value from 30 to 120 seconds. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.4.3.1.9 |

**Parameter: Poll Timer**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > EGP > Neighbors |
| Default: | 180 seconds |
| Options: | 120 to 480 seconds |
| Function: | Specifies the time period, in seconds, between the local EGP neighbor's EGP Poll message retransmissions. This variable represents the RFC 904 T2 timer. |
| Instructions: | Either accept the default value of 180 seconds for this parameter or set it to some value from 120 to 480 seconds. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.4.3.1.10 |

# IP Parameters


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## IP Configuration Parameters

**Parameter:** **IP Address**

Path: Select IP from the Select Protocols window and click on OK.

Default: None

Options: 0.0.0.0 or any valid IP address

Function: Assigns a 32-bit IP address to the interface.

Instructions: Enter the IP address of the interface in dotted-decimal notation. Enter 0.0.0.0 to configure an unnumbered interface on the circuit.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.4

**Parameter: Subnet Mask**

Path: Select IP from the Select Protocols window and click on OK.

Default: None

Options: The Configuration Manager automatically calculates an appropriate subnet mask, depending on the class of the network to which the interface connects. However, you can change the subnet mask with this parameter.

Function: Specifies the network and subnetwork portion of the 32-bit IP address.

Instructions: Either accept the assigned subnet mask or enter another subnet mask in dotted-decimal notation. Enter 0.0.0.0 if you are configuring an unnumbered interface on the circuit.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.6

**Parameter: Transmit Bcast Addr**

Path: Select IP from the Select Protocols window and click on OK.

Default: 0.0.0.0

Options: 0.0.0.0 or any valid IP broadcast address

Function: Specifies the broadcast address that this IP subnet uses to broadcast packets.Accepting 0.0.0.0 for this parameter specifies that the IP router will use a broadcast address with a host portion of all 1s. Accepting 0.0.0.0 does not configure the router to use the address 0.0.0.0 to broadcast packets. For example, if you have IP address 123.1.1.1 and a subnet mask of 255.255.255.0, accepting the default value 0.0.0.0 configures the IP router to use the address 123.1.1.255 to broadcast packets. To set the explicit broadcast address of all 1s, enter 255.255.255.255 for this parameter.

Instructions: Accept the default, 0.0.0.0, unless the calculated broadcast address (host portion) of all 1s is not adequate. If this is the case, then enter the appropriate IP broadcast address in dotted-decimal notation. If you set the IP Address parameter to 0.0.0.0 (to configure an unnumbered interface), Site Manager automatically sets this parameter to 255.255.255.255.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.8

| | |
|---|---|
| **Parameter:** | **UnNumbered Assoc Address** |
| Path: | Select IP from the Select Protocols window and click on OK. |
| Default: | None |
| Options: | Any valid IP address |
| Function: | Specifies an address that IP uses when sourcing a packet. RIP uses this address to make decisions about advertising subnets over the unnumbered interface. RIP advertises subnets over the unnumbered interface if the subnets have the same mask as the associated address. |
| Instructions: | Specify the address of any numbered interface on the router. If you are running RIP over the unnumbered interface and if you are using a subnet address as the associated address, the local and remote associated addresses should have the same network number. If you configure local and remote associated addresses using different network numbers, you must use RIP2 mode. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.4.1.110 |

## IP Interface Parameters

| | |
|---|---|
| **Parameter:** | **Enable** |
| Path: | Configuration Manager > Protocols > IP > Interfaces |
| Default: | Enable |
| Options: | Enable \| Disable |
| Function: | Enables or disables IP routing on this interface. |
| Instructions: | Set to Disable to disable IP routing over this circuit. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.4.1.2 |

| | |
|---|---|
| **Parameter:** | **Subnet Mask** |
| Path: | Configuration Manager > Protocols > IP > Interfaces |
| Default: | You specified the subnet mask when you added IP to the circuit. |
| Options: | Depend on the class of the network to which the interface connects |
| Function: | Specifies the network and subnetwork portion of the 32-bit IP address. |
| Instructions: | Enter the subnet mask in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.4.1.6 |

| | |
|---|---|
| **Parameter:** | **Broadcast Address** |
| Path: | Configuration Manager > Protocols > IP > Interfaces |
| Default: | You specified the broadcast address when you added IP to the circuit. |
| Options: | 0.0.0.0 or any IP address |
| Function: | Specifies the broadcast address that the IP router uses to broadcast packets. Accepting 0.0.0.0 for the broadcast address specifies that the IP router will use a broadcast address with a host portion of all 1s. Accepting 0.0.0.0 does not configure the router to use the address 0.0.0.0 to broadcast packets. For example, if you have set the IP address to 123.1.1.1 and the subnet mask to 255.255.255.0, accepting the default value 0.0.0.0 configures the IP router to use the address 123.1.1.255 to broadcast packets. For the explicit broadcast address of all 1s, enter 255.255.255.255 for this parameter. |
| Instructions: | Accept the default, 0.0.0.0, unless the calculated broadcast address (host portion) of all 1s is not adequate. If this is the case, then enter the appropriate IP broadcast address in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.4.1.9 |

| | |
|---|---|
| **Parameter:** | **Cost** |
| Path: | Configuration Manager > Protocols > IP > Interfaces |
| Default: | 1 |
| Options: | 1 to the value of the RIP diameter (maximum 127) |
| Function: | Sets the cost of this interface. The interface cost is added to routes learned on this interface through RIP and is specified in subsequent RIP packets transmitted out other interfaces. |
| Instructions: | Enter the interface cost value (standard RIP implementation assigns a cost of 1); however, keep in mind that increasing this value causes the upper bound set by the RIP Network Diameter parameter to be attained more rapidly. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.4.1.8 |

**Parameter: MTU Discovery**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Off

Options: On │ Off

Function: Specifies whether the Reply MTU option (option 11 in RFC 1063) is enabled on this interface. When the option is enabled, this interface responds to Probe MTUs (option 12 in RFC 1063). A probe MTU requests the minimum MTU (maximum transmission unit) of all networks an IP datagram must traverse from source to destination. By enabling this interface to respond to probe MTUs, you eliminate transit fragmentation and destination reassembly for datagrams destined for this interface and, therefore, decrease network load.

Instructions: Select On to enable the Reply MTU option on this interface; select Off to disable the option on this interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.10

**Parameter: Addr Mask Reply**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Off

Options: On │ Off

Function: Specifies whether this interface generates ICMP (Internet Control Message Protocol) address-mask reply messages in response to valid address-mask request messages. The interface generates ICMP address-mask reply messages in compliance with the relevant sections of RFCs 950 and 1009.

Instructions: Select On to enable ICMP address-mask reply message generation on this interface. Select Off to disable ICMP address-mask reply message generation on this interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.11

**Parameter: ASB**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Off

Options: On │ Off

Function: Specifies whether the IP router floods All Subnet Broadcast (ASB) datagrams it receives out this interface. An ASB datagram has a destination address equal to the broadcast address for an entire network (all subnets). For example, if a network interface serves the subnet 128.10.2.1 with a subnet mask of 255.255.255.0, the IP router considers any datagram with a destination address of 128.10.255.255 or 128.10.0.0 to be an ASB datagram.

Instructions: Specify On if you want the IP router to flood ASBs out this interface; specify Off to restrict the router from flooding ASBs out this interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.12

**Parameter: Address Resolution Type**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: ARP

Options: ARP │ X.25_DDN │ X.25_PDN │ INARP │ ARPINARP │ NONE │ X.25 │ BFEDDN │ PROBE │ ARPPROBE

Function: Indicates the address resolution scheme for this interface. The default option, ARP, enables ARP on this interface. The option INARP (Inverse ARP) enables the address resolution for frame relay interfaces. It is used to discover the IP address of the station at the remote end of the virtual circuit. The PROBE option enables HP Probe for Ethernet interfaces.

Instructions: Depending on your network requirements, select INARP only when all frame relay stations support Inverse ARP. Select ARPINARP for your frame relay interfaces. ARPINARP enables both ARP and Inverse ARP. Select X.25_DDN for your X.25 DDN interfaces. Select X.25_PDN for your X.25 PDN interfaces. Select PROBE to enable HP Probe on the interface. Select ARPPROBE to enable both ARP and HP Probe.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.13

**Parameter: Proxy**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Off

Options: On | Off

Function: Specifies whether this interface uses Proxy ARP to respond to ARPs for a remote network.

Instructions: Select On to enable Proxy ARP on this interface. In order to enable Proxy ARP, you must have set the ARP parameter to Enable for this interface. When you enable Proxy ARP, the IP router assumes responsibility for IP datagrams destined for the remote network. To enable Proxy ARP for subnets reachable via a default route, also set the Enable Default Route for Subnets parameter to Enable. To enable Proxy ARP for remote destinations on other networks, set the Nonlocal ARP Destination parameter to Accept. Select Off to disable Proxy ARP on this interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.14

**Parameter: Host Cache**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Off

Options: Off | 120 | 180 | 240 | 300 | 600 | 900 | 1200 (seconds)

Function: Specifies whether the IP router times out entries in the address-resolution cache for this interface, and specifies the timeout interval in seconds if the interface does time out entries. The address-resolution cache contains host physical addresses learned by means of ARP or Proxy ARP. A host entry is timed out (deleted) if the IP router sends no traffic destined for that host within the specified timeout period.

Instructions: Select Off to disable timeout on this interface; the IP router does not time out address-resolution cache entries. Select one of the other options to enable timeout with a timeout interval equal to the value you select (for example, 120 seconds); the IP router removes address-resolution cache entries that have not been accessed within the specified number of seconds. Once an entry is removed, the IP router must use ARP to reacquire the physical-level address.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.15

**Parameter: Upd Xsum On**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: On

Options: On | Off

Function: Specifies whether UDP checksum processing is enabled on this interface.

Instructions: Select On to enable UDP checksum processing for the interface; all outgoing and incoming UDP datagrams are subject to checksumming. You should select On in virtually all instances. Select Off to disable UDP checksum processing and provide backward compatibility with UNIX BSD 4.1.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.16

**Parameter: MAC Address**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: None

Options: 0 | a user-specified MAC address | if the interface is on an SMDS circuit, the entire E.164 address -- for example, C1 617 555 5000 FFFF

Function: Specifies a MAC (media access control) address for this IP interface. The IP router will use its IP address and this MAC address when transmitting and receiving packets on this interface.

Instructions: Enter 0 to configure the IP router to use its IP address and the circuit's MAC address when transmitting packets on this interface. Enter your own MAC address to configure the IP router to use its IP address and the specified MAC address when transmitting packets on this interface. If the interface is on an SMDS circuit, by default, IP uses the SMDS-configured address. To configure this parameter for a multinet or multigroup configuration, see *Configuring SMDS*.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.17

**Parameter:** **TR Endstation**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Off

Options: On │ Off

Function: Specifies source routing over token ring selection.

Instructions: Use the On option to enable the parameter.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.64

**Parameter:** **Redirect**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Enable

Options: Enable │ Disable

Function: Indicates whether this interface sends out ICMP redirects. ICMP redirects are messages sent by the router to alert a host that it should be using a different path to route data.

Instructions: Reset to Disable if you do not want this interface to send out redirects. For example, in a frame relay network, two stations on the same network may not be directly connected if the network is not fully meshed. Thus, in this case, you would set the Redirect parameter to Disable.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.70

**Parameter: Ethernet Arp Encaps**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: ARP Ethernet

Options: ARP Ethernet | ARP SNAP | ARP Both | Probe LSAP | ARP Ethernet/Probe LSAP | ARP SNAP/Probe LSAP | ARP Both/Probe LSAP

Function: Defines the data link encapsulation to use for ARP and HP Probe packets generated at this interface if the underlying medium is Ethernet. This parameter is ignored if the underlying medium is anything other than Ethernet.

Instructions: Depending on the selection you have made for the ARP Resolution parameter (ARP, Probe, or ARP/Probe), select the appropriate encapsulation option. If your address-resolution scheme is ARP only, select Ethernet encapsulation, SNAP encapsulation, or Ethernet/SNAP encapsulation. If your resolution scheme is HP Probe only, select LSAP encapsulation. If your resolution scheme is ARP/Probe, select Ethernet/LSAP encapsulation, SNAP/LSAP encapsulation, or Ethernet/SNAP/LSAP encapsulation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.71

**Parameter: SMDS Group Address**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: The SDMS-configured address

Options: A complete SMDS E.164 address specified by the SMDS subscription agreement that you have with your SMDS provider

Function: Provides a MAC-layer multicast address for this IP interface in an SMDS network. This parameter is displayed only if this is an SMDS circuit.

Instructions: Enter an entire E.164 address -- for example, E1 617 555 1212 FFFF. If you do not supply an address, IP uses the SDMS-configured address. To configure this parameter for a multinet or multigroup configuration, see *Configuring SMDS.*

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.65

**Parameter: SMDS Arp Request Address**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: The SDMS-configured address

Options: A complete SMDS E.164 address specified by the SMDS subscription agreement that you have with your SMDS provider

Function: Provides an address-resolution multicast address for this IP interface in an SMDS network. This parameter is displayed only if this is an SMDS circuit.

Instructions: Enter an entire E.164 address -- for example, E1 617 555 1212 FFFF. If you do not supply an address, IP uses the SDMS-configured address. To configure this parameter for a multinet or multigroup configuration, see *Configuring SMDS*.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.66

**Parameter: FRM Broadcast**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: 0

Options: Any decimal number

Function: Provides a broadcast address for this IP interface in a frame relay network. If you enter a value for this parameter, the frame relay switch, rather than the router, will broadcast the message. This parameter is displayed only if this is a frame relay circuit.

Instructions: Enter the broadcast address provided by the frame relay subscription agreement.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.67

**Parameter: FRM Cast 1 DLCI**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: 0

Options: Any decimal number

Function: Provides a multicast address for this IP interface that will send messages to all OSPF routers in a frame relay network. If you enter a value for this parameter, the frame relay switch, rather than the router, will send the message to all OSPF routers. This parameter has meaning only if OSPF has been added to this interface.

Instructions: Enter the multicast address for all OSPF routers as provided by the frame relay subscription agreement.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.68

**Parameter: FRM Cast 2 DLCI**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: 0

Options: Any decimal number

Function: Provides a multicast address for this IP interface that will send messages to all OSPF designated routers in a frame relay network. If you enter a value for this parameter, the frame relay switch, rather than the router, will send the message to all OSPF designated routers. This parameter has meaning only if OSPF has been added to this interface.

Instructions: Enter the multicast address for all OSPF designated routers as provided by the frame relay subscription agreement.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.69

**Parameter: Mask**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Slot-mask bit set to 1 (enabling circuitless IP interface support) for every router slot running IP

Options: For each slot in the router, Site Manager allows you to set the slot-mask bit to 1 (circuitless IP interface support enabled) or 0 (circuitless IP interface support disabled).

Function: Specifies whether circuitless IP interface support is enabled or disabled on each slot in the router.

Instructions: If you configured a circuitless IP interface and do not want it to run on certain slots, set the slot-mask bit to 0 on those slots. Be certain to keep the slot-mask bit set to 1 on at least one slot running IP; otherwise, the circuitless IP interface will not initialize. Setting the slot-mask bit parameter to 1 on an empty slot, a slot containing a system resource module, or a slot with no IP support does not affect the circuitless IP interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.75

**Parameter:** **Forward Cache Size**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: 128 entries

Options: 64-entry minimum; no maximum

Function: Specifies the maximum number of entries allowed in the forwarding table at one time.

Instructions: Specify a forwarding table size for each interface. This parameter controls the number of destinations that are cached in the forwarding table on this receiving interface. When this interface receives an IP packet, the router looks up the destination in the forwarding table. Therefore, an interface that receives packets for a large number of destinations may benefit from a larger forwarding table. The larger the number of entries, the more likely it is that the destination will already be in the forwarding table and the faster the route lookups will be for those destinations. Configuring a forwarding table size that is larger than necessary reduces the total amount of memory usable by other applications. Configuring a routing table too small can affect overall router performance. A check of the number of cache hits and misses will help determine the optimal size of the forwarding table. For debugging purposes, if you see the wfIpInterfaceCacheMisses statistic going up at an alarming rate, you should consider increasing the table size. However, an occasional cache miss does not warrant an increase in table size.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.104

**Parameter:** **Enable Security**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Disable

Options: Enable | Disable

Function: Specifies whether Revised IP Security Option (RIPSO) is enabled for the interface.

Instructions: If you do not support RIPSO on your network, simply accept the default setting, Disable. If you are configuring RISPO support, set this parameter to Enable. Once you set this parameter to Enable, you can access the rest of the RIPSO parameters. If you do not enable this parameter, Site Manager does not activate the RIPSO parameters.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.76

**Parameter:** **Unnumbered Associated Alternate**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Disable

Options: Enable | Disable

Function: Automatically assigns an alternate associated address to an unnumbered interface in the event that the primary associated address has gone down. IP uses the first available interface.

Instructions: Use the alternate unnumbered address option to ensure that the unnumbered interface has a usable associated address on the router.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.111

**Parameter:** **ATM ARP Mode**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Client

Options: Client | Server

Function: Specifies whether the router is running as an ATM client or server on this interface.

Instructions: You must configure one ATMARP server for each logical IP subnet you define.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.112

**Parameter:** **ARP Server ATM Address Network Prefix**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: None

Options: XX00000000000000000000000 to XXFFFFFFFFFFFFFFFFFFFFFF where XX = 39, 45, or 47

Function: Defines the ATM address network prefix of the ATMARP server on your network.

Instructions: Enter the ATM address network prefix of the ATMARP server on your network. A complete ATM address consists of a network prefix and a user part. Use the ARP Server ATM Address User Part parameter to supply the user part of the ATM address.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.113

**Parameter:** **ARP Server ATM Address User Part**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: None

Options: XX00000000000000 to FEFFFFFFFFFFF

Function: Defines the user part (suffix) of the ATM address for the ATM ARP server on your network. The user part consists of a 6-byte end station identifier and a 1-byte selector field.

Instructions: Enter the user part suffix of the ATM ARP server on your network. A complete ATM address consists of a network prefix and a user part. Use the ARP Server ATM Address Network Prefix parameter to supply the network part of the ATM address.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.113

**Parameter:** **Registration Refresh Interval**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: 900 seconds for a client, 1,200 seconds for a server

Options: Any interval (in seconds)

Function: For a client, this parameter specifies the interval between registration refreshes. For a server, this parameter specifies the duration for which the registration is valid.

Instructions: Determine whether ATMARP is running as a client or as a server on this interface and enter an appropriate value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.115

**Parameter:** **TR Endstation ARP Type**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: STE

Options: STE | ARE

Function: Specifies the ARP type for an interface configured for token ring support.

Instructions: For spanning tree explorer (STE) ARP packets, use the default. For all route explorer (ARE) packets, select ARE. Set the TR Endstation parameter to on.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.1.127

## IP Global Parameters

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > Global

Default: This parameter defaults to Enable when you add IP support to a circuit.

Options: Enable | Disable

Function: Specifies the state of the IP router software.

Instructions: Select Enable if you have previously disabled the IP router software and now wish to reenable it. Select Disable to disable the IP router software. In dynamic mode, when you set this parameter to Disable, you immediately prohibit all Site Manager communication with the router.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.2

**Parameter: Forwarding**

Path: Configuration Manager > Protocols > IP > Global

Default: Forwarding

Options: Forwarding | Not Forwarding

Function: Specifies whether the IP router forwards IP traffic that is not explicitly addressed to it.

Instructions: Select Forwarding if you want the IP router to route (forward) IP traffic. Forwarding configures the IP router to process all broadcast packets and all IP packets explicitly addressed to it, and to route all other IP packets. Select Not Forwarding if you want to provide IP management access (by means of TFTP and SNMP) to all active IP interfaces but also want to prohibit the IP router from forwarding IP traffic. You must specify an identical IP address and mask combination for each active IP interface that will provide management access. Not Forwarding configures the IP router to act as an IP host; it does not forward IP traffic, but it still processes packets explicitly addressed to it. In Not Forwarding mode, only static routes and adjacent-host routes are allowed. No routing protocols are initiated. Because the IP router does not forward IP traffic in Not Forwarding mode, you must configure the router to bridge IP traffic not explicitly addressed to it. You must configure the bridge for each circuit that conveys IP datagrams. The bridge then forwards all IP datagrams that are not explicitly addressed to the router.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.4

**Parameter: ARP Forwarding**

Path: Configuration Manager > Protocols > IP > Global

Default: Forwarding

Options: Forwarding | Not Forwarding

Function: Specifies how ARP should act in relation to IP's forwarding state. Note that Forwarding means IP is in forwarding mode. If this parameter is set to Forwarding, then ARP packets are either consumed (if destined for the router) or dropped. If this parameter is set to Not Forwarding, ARP packets are consumed, if destined for the router, or bridged onto remaining ARP interfaces.

Instructions: Always set this parameter the way you set the Forwarding parameter.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.1.1.3

**Parameter: Nonlocal ARP Source**

Path: Configuration Manager > Protocols > IP > Global

Default: Drop

Options: Drop | Drop and Log

Function: Determines what happens when IP encounters an invalid ARP source address. If this parameter is set to Drop and Log, IP logs an invalid ARP source address when processing an ARP request. If this parameter is set to Drop, IP does not log the invalid ARP source address. In either case, IP drops the invalid ARP request.

Instructions: If you want to log the invalid ARP source address, set the parameter to Drop and Log. Otherwise, set the parameter to Drop.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.1.1.4

**Parameter: Nonlocal ARP Destination**

Path: Configuration Manager > Protocols > IP > Global

Default: Drop

Options: Drop | Accept

Function: Determines whether IP drops ARP requests in which the source and destination addresses are located in different networks or subnetworks. This parameter allows Proxy ARP to generate replies when the source and destination networks in the ARP request are different.

Instructions: To process ARP requests with source and destination addresses from different networks, set the parameter to Accept. The Proxy parameter must be set to Enable for the router to generate ARP replies.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.1.1.5

**Parameter: Default TTL**

Path: Configuration Manager > Protocols > IP > Global

Default: 30

Options: 1 to 255 hops

Function: Specifies the starting value of the time to live (TTL) counter for each packet the router originates and transmits (called a source packet). When the router transmits a source packet, the TTL counter starts to decrement. Each router, or hop, that the packet traverses decrements the TTL counter by one. When the counter reaches zero, the router discards the packet unless it is destined for a locally attached network. The TTL counter prevents packets from looping endlessly through the network.

Instructions: Enter the maximum number of hops a source packet can traverse.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.5

**Parameter: RIP Diameter**

Path: Configuration Manager > Protocols > IP > Global

Default: 15

Options: 1 to 127

Function: Specifies the value, or hop count, the Routing Information Protocol (RIP) uses to denote infinity. In order for RIP to operate properly, every router within the network must be configured with an identical RIP diameter value. If RIP is not enabled, this parameter specifies the maximum number of hops within the autonomous system; if RIP is not enabled, the IP router still must understand network width.

Instructions: You must set this parameter so that none of the interface cost, static cost, or route filter cost parameters exceed the RIP diameter. Bay Networks recommends that you accept the default RIP diameter value of 15.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.6

**Parameter: Zero Subnet Enable**

Path: Configuration Manager > Protocols > IP > Global

Default: Disable

Options: Enable │ Disable

Function: Specifies whether an interface address whose subnet portion is all zeros or all ones should be declared legal or not. If you set this parameter to Enable, then you can configure IP interfaces with a subnet ID of zero. Setting this parameter to Disable prevents you from doing so.

Instructions: Accept the default, Disable, if you do not have any interfaces that have a zero subnet ID. Otherwise, reset this parameter to Enable. The use of all-zero subnet addresses is discouraged for the following reason: if an all-zero subnet address and an all-zero broadcast address are both valid, the router cannot distinguish an all-subnets broadcast from a directed broadcast for the zero subnet.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.10

**Parameter: Estimated Networks**

Path: Configuration Manager > Protocols > IP > Global

Default: 0

Options: 0 to 2,147,483,647

Function: Allows the IP software to preallocate system resources based on the anticipated size of the routing table. Preallocation of memory increases the speed with which IP software can learn routes because it removes the overhead caused by dynamic memory allocation. Preallocation also makes better use of memory and reduces the amount of memory required.

Instructions: Set to the number of networks (including unique subnets) that you expect. Avoid using a number that is excessively large. This will cause a wasteful overallocation of memory. If you use the default value, 0, IP software preallocates memory for 500 routing table entries.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.11

**Parameter: Estimated Hosts**

Path: Configuration Manager > Protocols > IP > Global

Default: 0

Options: 0 to 2,147,483,647

Function: Allows the IP software to preallocate system resources based on the anticipated size of the routing table. Preallocation of memory increases the speed with which IP software can learn routes because it removes the overhead caused by dynamic memory allocation.

Instructions: Set to the number of hosts that you expect. Avoid using a number that is excessively large. This will cause a wasteful overallocation of memory. If you use the default value, 0, IP software preallocates memory for 500 routing table entries.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.13

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|---|---|
| **Parameter:** | **Enable Default Route for Subnets** |
| Path: | Configuration Manager > Protocols > IP > Global |
| Default: | Disable |
| Options: | Enable \| Disable |
| Function: | Specifies whether the IP router uses a default route for unknown subnets. The default route must be present in the routing table. When you set this parameter to Enable, the IP router uses a default route. When you set this parameter to Disable, the IP router does not use a default route. |
| Instructions: | Accept the default, Disable, if you do not want the IP router to use a default route for unknown subnets. Otherwise, reset this parameter to Enable. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.1.14 |

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|---|---|
| **Parameter:** | **Maximum Policy Rules** |
| Path: | Configuration Manager > Protocols > IP > Global |
| Default: | 32 |
| Options: | Any integer |
| Function: | Specifies the maximum number of policy rules that can be configured per policy type (accept or announce) per protocol. |
| Instructions: | To configure more than 32 accept or announce policy rules for a protocol, you must set this parameter to a larger value. IP will round the value up to the next multiple of 32. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.1.15 |

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|---|---|
| **Parameter:** | **Route Filter Support** |
| Path: | Configuration Manager > Protocols > IP > Global |
| Default: | Enable |
| Options: | Enable \| Disable |
| Function: | Specifies whether or not IP supports route filters. |
| Instructions: | If you do not require support for route filters, select Disable. Otherwise, use the default. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.1.16 |

**Parameter:** **RIP Maximum Equal Cost Paths**

Path: Configuration Manager > Protocols > IP > Global

Default: 1

Options: 1 to 5

Function: Specifies the maximum number of equal-cost paths allowed for a network installed in the routing table by RIP.

Instructions: Use the IP global Multipath Method parameter to enable multipath costs and specify the method that IP uses to choose the next hop for a datagram.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.17

**Parameter:** **Multiple Nexthop Calculation Method**

Path: Configuration Manager > Protocols > IP > Global

Default: Disable

Options: Enable | Disable

Function: Enables and disables equal-cost multipath support for RIP and OSPF and specifies the method that IP uses to choose the next hop when more than one is available. Three methods are available: round-robin selection, selection based on the source addresses (IP forwards all packets with the same source address to the same next hop), and selection based on the source and destination address (IP forwards all packets with the same source and destination address to the same next hop).

Instructions: Configure RIP and OSPF to support equal-cost routes to the same destination.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.18

**Parameter:** **OSPF Maximum Path**

Path: Configuration Manager > Protocols > IP > OSPF > Global

Default: 1 path

Options: 1 to 5 equal-cost paths

Function: Specifies the maximum number of equal-cost paths allowed for a network installed by OSPF.

Instructions: If you have enabled equal-cost multipath support on the router, specify a value from 2 to 5.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.18

**Parameter: Enable ISP Mode Support**

Path: Configuration Manager > Protocols > IP > Global
Default: Disable
Options: Enable | Disable
Function: Enables and disables internet service provider (ISP) features.
Instructions: Use this parameter to configure BGP as a soloist and to disable the use of forwarding tables on IP interfaces.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.19

**Parameter: IBGP ECMP Enable**

Path: Configuration Manager > Protocols > IP > Global
Default: Disable
Options: Enable | Disable
Function: Allows BGP to select an IP route to the IBGP next hop using available ECMP routing information supplied by the IGP (RIP or OSPF) used in the AS.
Instructions: Make sure that ECMP is enabled for the IGP used in the AS.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.23

**Parameter: Percentage of ARP Buffers**

Path: Configuration Manager > Protocols > IP > Global
Default: 100
Options: An integer indicating the percentage of buffers
Function: Defines the upper limit (as a percentage) of buffers that ARP can use for saving buffers when resolving ARP requests.
Instructions: Specify the percentage as an integer.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.1.27

## Static Route Parameters

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > Static Routes

Default: This parameter defaults to Enable when you configure the static route.

Options: Enable │ Disable

Function: Specifies the state (active or inactive) of the static route record in the IP routing tables.

Instructions: Select Disable to make the static route record inactive in the IP routing table; the IP router will not consider this static route. Select Enable to make the static route record active again in the IP routing table.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.5.1.2

**Parameter: Destination IP Address**

Path: Configuration Manager > Protocols > IP > Static Routes

Default: None

Options: Any valid IP network address

Function: Specifies the IP address of the network to which you want to configure the static route. Specifies a supernet for which you want to configure a black hole static route.

Instructions: Enter the destination IP address in dotted-decimal notation. To configure a default route, enter 0.0.0.0. To configure a black hole static route, enter a supernet address. You can configure up to 12 static routes to the same destination.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.5.1.3

**Parameter: Address Mask**

Path: Configuration Manager > Protocols > IP > Static Routes

Default: None

Options: Based on the network class of the IP address you specified at the Destination IP Address parameter

Function: Specifies the subnet mask of the destination network. Specifies the supernet mask of the supernet for which you want to configure a black hole static route.

Instructions: Enter the subnet or supernet mask in dotted-decimal notation. To configure a default route, enter 0.0.0.0. To configure a black hole static route, enter a supernet mask.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.5.1.4

**Parameter: Cost**

Path: Configuration Manager > Protocols > IP > Static Routes

Default: 1

Options: 1 to the value of the RIP Diameter parameter (maximum 126)

Function: Specifies the number of router hops a datagram can traverse before reaching the destination IP address. The IP router uses the cost value when determining the best route for a datagram to follow.

Instructions: Enter the number of router hops.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.5.1.5

**Parameter: Next Hop Addr**

Path: Configuration Manager > Protocols > IP > Static Routes

Default: 0.0.0.0

Options: Any valid IP address

Function: Specifies the IP address of the next-hop router. Defines a black hole route for a supernet.

Instructions: Enter the IP address in dotted-decimal notation. To configure a black hole static route, enter 255.255.255.255. If you are configuring a static route to an unnumbered interface, enter 0.0.0.0.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.5.1.6

**Parameter: Next Hop Mask**

Path: Configuration Manager > Protocols > IP > Static Routes

Default: 0.0.0.0

Options: Any valid subnet mask address

Function: Specifies the subnet mask of the next-hop router. The parameter also defines a black hole route for a supernet.

Instructions: Enter the subnet mask in dotted-decimal notation. To configure a black hole static route, enter 255.255.255.255. If you are configuring a static route to an unnumbered interface, enter 0.0.0.0.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.5.1.7

**Parameter: Preference**

Path: Configuration Manager > Protocols > IP > Static Routes

Default: 16

Options: 1 to 16

Function: Specifies a weighted value (from 1 to 16, with 16 being the most preferred) that the IP router uses to select a route when its routing tables contain multiple routes to the same destination.

Instructions: Enter a value from 1 to 16 for this static route. To configure a black hole static route, enter the maximum preference value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.5.1.8

**Parameter: Unnumbered CCT Name**

Path: Configuration Manager > Protocols > IP > Static Routes

Default: None

Options: A valid circuit name

Function: Specifies the local router circuit associated with the static route over an unnumbered interface.

Instructions: An entry for a route using an unnumbered interface must include the circuit associated with the interface. Use this parameter to specify that circuit name.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.5.1.11

## Adjacent Host Parameters

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > Adjacent Hosts
Default: Enable
Options: Enable | Disable
Function: Specifies the state (active or inactive) of the adjacent host in the IP routing tables.
Instructions: Select Disable to make the adjacent host record inactive in the IP routing table; the IP router will not consider this adjacent host. Select Enable to make the adjacent host record active again in the IP routing table.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.6.1.2

**Parameter: Adjacent Host Address**

Path: Configuration Manager > Protocols > IP > Adjacent Hosts
Default: None
Options: Any valid IP address
Function: Specifies the IP address of the device for which you want to configure an adjacent host.
Instructions: Enter the IP address in dotted-decimal notation.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.6.1.3

**Parameter: Next Hop Interface Addr**

Path: Configuration Manager > Protocols > IP > Adjacent Hosts
Default: 0.0.0.0
Options: A valid IP address
Function: Specifies the IP address of the router's network interface to the adjacent host.
Instructions: Enter the IP address in dotted-decimal notation.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.6.1.4

**Parameter: MAC Address**

Path: Configuration Manager > Protocols > IP > Adjacent Hosts

Default: None

Options: Depend on the data link you have selected

Function: Specifies the physical address of the adjacent host. This value can be a 48-bit Ethernet address, a 64-bit SMDS address, an ATM PVC VPI/VCI address, or, for an ATM SVC, the address of the ATM interface.

Instructions: Enter the MAC address as a 12-digit hexadecimal number. Enter an ATM/PVC address in the form virtual path identifier/virtual channel identifier -- for example, 0/32.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.6.1.6

**Parameter: Host Encapsulation**

Path: Configuration Manager > Protocols > IP > Adjacent Hosts

Default: Ethernet

Options: Ethernet | SNAP | PDN | DDN | SNAPIP | NULL

Function: Specifies the adjacent host's encapsulation method.

Instructions: Select Ethernet or SNAP (Service Network Access Point) if you are defining a point-to-point network interface or if the adjacent host resides on an Ethernet. For an X.25 interface, select PDN or DDN. For an adjacent host on an ATM logical IP subnet, select SNAP. (SNAPIP and NULL also specify host encapsulation methods for ATM networks.)

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.6.1.7

**Parameter: Adjacent Host X.121 Address**

Path: Configuration Manager > Protocols > IP > Adjacent Hosts

Default: None

Options: Any valid X.121 address

Function: Specifies the X.121 address of the adjacent host. Set this parameter only if this is a PDN/X.25, DDN/X.25, or BFE/X.25 connection.

Instructions: Enter the appropriate X.121 address.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.6.1.9

**Parameter: Remote Party Sub-Address**

Path: Configuration Manager > Protocols > IP > Adjacent Hosts
Default: None
Options: An SVC subaddress
Function: Specifies the subaddress used to establish an SVC to the adjacent host.
Instructions: Supply a valid SVC subaddress.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.6.1.10

**Parameter: Remote Party Type of Number**

Path: Configuration Manager > Protocols > IP > Adjacent Hosts
Default: International
Options: International | Unknown
Function: Specifies the type of number used to establish an SVC to the adjacent host.
Instructions: Supply the required value.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.6.1.11

**Parameter: Adjacent Host Type**

Path: Configuration Manager > Protocols > IP > Adjacent Hosts
Default: Default
Options: FRE 164 | Default | FRX 121 | FRDLCI
Function: Specifies the type of adjacent host.
Instructions: Supply a value.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.6.1.12

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|---|---|
| **Parameter:** | **GRE Connection Name** |
| Path: | Configuration Manager > Protocols > IP > Adjacent Hosts |
| Default: | None |
| Options: | A GRE connection name |
| Function: | Specifies the name of the remote GRE connection to which an adjacent host is configured. |
| Instructions: | Supply an ASCII string. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.6.1.13 |

## RIPSO Parameters

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|---|---|
| **Parameter:** | **Enable Security** |
| Path: | Configuration Manager > Protocols > IP > Interfaces |
| Default: | Enable |
| Options: | Enable \| Disable |
| Function: | Enables or disables IP security options for this interface. |
| Instructions: | Set to Disable if you want to disable IP security options. If you set this parameter to Disable, then the router accepts only the following IP datagrams: labeled IP datagrams with the classification level set to Unclassified and no authority flags set, and unlabeled IP datagrams. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.4.76 |

| | |
|---|---|
| **Parameter:** | **Strip Security** |
| Path: | Configuration Manager > Protocols > IP > Interfaces |
| Default: | None |
| Options: | None \| Incoming \| Outgoing \| All |
| Function: | Specifies the type of IP datagram from which the router should remove the IP security options. |
| Instructions: | Select the type of IP datagram from which you want IP security options to be removed. None causes the router to leave IP security options on all inbound and outbound IP datagrams intact. Incoming causes the router to strip the IP security option from each incoming IP datagram, after checking the IP datagram against the interface's security configuration. Outgoing causes the router to strip the IP security option from each outgoing IP datagram, before checking each datagram against the interface's security configuration. All causes the router to strip the IP security options from both incoming and outgoing IP datagrams: incoming datagrams after checking each against this interface's security configuration and outgoing datagrams before checking each against the interface's security configuration. If you set this parameter to Outgoing or All, then you must set the Require Out Security parameter to None. (Similarly, if you set the Require Out Security parameter to Forwarded, Originated, or All, then you must set this parameter to None or Incoming.) |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.4.77 |

**Parameter: Require Out Security**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: All

Options: None │ Forwarded │ Originated │ All

Function: Specifies which type of outbound datagrams require IP security labels.

Instructions: Select None: the router forwards unlabeled IP datagrams unchanged on this interface. In addition, those IP datagrams that it originates and transmits do not require labels. Select Forwarded: the router requires all IP datagrams it forwards on this interface (not those it originates) to contain basic IP security options. If the datagram already contains an IP security label, the router forwards the datagram unchanged. If the datagram is unlabeled, the router adds the implicit or default label to the datagram before forwarding it. Select Originated: the router specifies basic IP security options for all IP datagrams it originates and transmits on this interface. The router adds the default label to IP datagrams it originates and transmits on this interface. Select All: the router requires all datagrams (both those that it forwards and those it originates) on this interface to contain basic IP security options. It supplies the implicit or default label for those datagrams that do not already contain one. If you set this parameter to Originated or All, then you must enable the Default Label and Error Label parameters.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.78

**Parameter: Require In Security**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: All

Options: None │ All

Function: Specifies which type of incoming IP datagram requires security labels.

Instructions: Select None: the router does not require inbound IP datagrams to contain labels. Select All: the router requires all inbound IP datagrams received on this interface to contain basic IP security options.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.79

**Parameter: Min Level**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Unclassified

Options: Unclassified │ Confidential │ Secret │ Top Secret

Function: Specifies the minimum security level that the router allows for inbound or outbound IP datagrams. This parameter, together with the Max Level parameter, specifies the range of classification levels that the router will accept and process. The router drops IP datagrams it receives on this interface that are below the specified minimum level.

Instructions: Select a minimum security level for this interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.80

**Parameter: Max Level**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Top Secret

Options: Unclassified │ Confidential │ Secret │ Top Secret

Function: Specifies the maximum security level that the router allows for inbound or outbound IP datagrams. This parameter, together with the Min Level parameter, specifies the range of classification levels that the router accepts. The router drops IP datagrams it receives or transmits on this interface that are above the specified maximum level.

Instructions: Select a maximum security level for this interface. The maximum level must be greater than or equal to the minimum level.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.81

**Parameter: Must Out Authority**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: No authority flags selected

Options: No authority flags selected | GENSER | SIOPESI | SCI | NSA | DOE

Function: Specifies which authority flags must be set in the protection authority field of all outbound datagrams.

Instructions: Select all of those authority flags that the router must set in all outbound IP datagrams it transmits on this interface. If you do not select any authority flags (the default setting), the router does not set any protection authority flags in outbound IP datagrams.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.82

**Parameter: May Out Authority**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Any

Options: Any | GENSER | SIOPESI | SCI | NSA | DOE

Function: Specifies which authority flags may be set in the protection authority field of all outbound datagrams. The authority flags you specify here must be a superset of the authority flags you specify for the Must Out Authority parameter.

Instructions: The default setting specifies that any of the authority flags may be set. Either accept the default setting or reset and select only those authority flags that are appropriate.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.83

**Parameter: Must In Authority**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: No authority flags selected

Options: No authority flags selected | GENSER | SIOPESI | SCI | NSA | DOE

Function: Specifies which authority flags must be set in the protection authority field of inbound IP datagrams.

Instructions: Select all of those authority flags that must be set in inbound IP datagrams received on this interface. If you do not select any authority flags (the default setting), then the router does not require a datagram to have authority flags set, but still accepts the datagram if any flags are set.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.84

**Parameter: May In Authority**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Any

Options: Any | GENSER | SIOPESI | SCI | NSA | DOE

Function: Specifies which authority flags may be set in the protection authority field of inbound IP datagrams. The authority flags you specify here must be a superset of the authority flags you specify for the Must In Authority parameter.

Instructions: The default setting specifies that any of the authority flags may be set. Either accept the default setting or reset and select only those authority flags that are appropriate.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.85

**Parameter: Implicit Label**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Enable

Options: Enable | Disable

Function: If you select Enable, the router uses the Implicit Authority and Implicit Level fields to create an implicit label. The router supplies the implicit label to unlabeled inbound datagrams received by this interface. If you select Disable, the router does not supply implicit labels for this interface.

Instructions: Accept the default, Enable, to allow the router to supply implicit labels for unlabeled inbound datagrams.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.86

**Parameter: Implicit Authority**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: No authority flags selected

Options: No authority flags selected | GENSER | SIOPESI | SCI | NSA | DOE

Function: Specifies the authority flags that the router sets when it supplies implicit security labels for unlabeled inbound IP datagrams.

Instructions: Select all of those authority flags that the router should set when it supplies an implicit security label. The set of authority flags you specify here must include the set of authority flags you specified for the Must In Authority parameter, and cannot include any of the flags you did not specify for the May In Authority parameter.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.87

**Parameter: Implicit Level**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Unclassified

Options: Unclassified | Confidential | Secret | Top Secret

Function: Specifies the security level that the router sets when it supplies implicit security labels for unlabeled, inbound IP datagrams.

Instructions: Specify a level within the range specified by the Min Level and Max Level parameters.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.88

**Parameter: Default Label**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Enable

Options: Enable | Disable

Function: If you select Enable, the router uses the Default Authority and Default Level fields to create a default label. The router supplies the default label to unlabeled outbound datagrams originated or forwarded out this interface. If you select Disable, the router does not supply default labels for this interface.

Instructions: To allow the router to supply default labels for unlabeled outbound datagrams, accept the default, Enable.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.89

**Parameter: Default Authority**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: No authority flags selected

Options: No authority flags selected | GENSER | SIOPESI | SCI | NSA | DOE

Function: Specifies the authority flags that the router uses when it supplies default security labels to unlabeled outbound IP datagrams.

Instructions: Select those authority flags that the router should set when it supplies default security labels. The set of authority flags you specify must include the set of authority flags specified for the Must Out Authority parameter, and cannot include any of the flags you did not specify for the May Out Authority parameter.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.90

**Parameter: Default Level**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Unclassified

Options: Unclassified | Confidential | Secret | Top Secret

Function: Specifies the security level that the router sets when it supplies default security labels to unlabeled outbound IP datagrams.

Instructions: Specify a default level within the range specified by the Min Level and Max Level parameters.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.91

**Parameter: Error Label**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: Enable

Options: Enable | Disable

Function: If you select Enable, the router uses the Error Authority and Min Level fields to create an error label. The router supplies the error label to outbound ICMP error datagrams. If you select Disable, the router does not supply error labels for this interface.

Instructions: To allow the router to supply error labels for outbound ICMP error datagrams, accept the default, Enable.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.92

**Parameter: Error Authority**

Path: Configuration Manager > Protocols > IP > Interfaces

Default: No authority flags selected

Options: No authority flags selected | GENSER | SIOPESI | SCI | NSA | DOE | ALL

Function: Specifies the authority flags that the router uses when it supplies error security labels to outbound ICMP error datagrams.

Instructions: Select those authority flags that the router should set when it supplies error security labels to outbound ICMP error datagrams. The set of authority flags you specify here must include the set of authority flags you specified for the Must Out Authority parameter, and cannot include any of the flags you did not specify for the May Out Authority parameter.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.4.93

## Router Discovery Parameters

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > Router Discovery
Default: Enable
Options: Enable | Disable
Function: Disables and enables Router Discovery on this interface.
Instructions: If you configured this interface with Router Discovery, use this parameter to disable Router Discovery.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.17.1.2

**Parameter: Broadcast Type**

Path: Configuration Manager > Protocols > IP > Router Discovery
Default: Multicast
Options: Multicast | Local | Direct
Function: Specifies the type of broadcast to use in sending advertisements.
Instructions: Use Multicast wherever possible; that is, on any link where all listening hosts support IP multicast.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.17.1.5

**Parameter: Minimum Interval**

Path: Configuration Manager > Protocols > IP > Router Discovery
Default: 450
Options: A value specifying the number of seconds
Function: Specifies the minimum time interval between advertisements.
Instructions: Specify a value that is no less than 3 seconds and less than the value you set for the Maximum Interval parameter.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.17.1.6

**Parameter: Maximum Interval**

Path: Configuration Manager > Protocols > IP > Router Discovery
Default: 600
Options: A value specifying the number of seconds
Function: Specifies the maximum time interval between advertisements.
Instructions: Specify a value that is not less than 4 seconds, is greater than the value you specified for the Minimum Interval parameter, and is not greater than 1,800 seconds.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.17.1.7

**Parameter: Lifetime**

Path: Configuration Manager > Protocols > IP > Router Discovery
Default: 1,800
Options: A value specifying the number of seconds
Function: Specifies the maximum length of time that the advertised addresses are to be considered as valid router addresses by hosts, in the absence of further advertisements.
Instructions: Specify a value that is no less than the value you set for the Maximum Interval parameter and no greater than 9,000 seconds.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.17.1.8

**Parameter: Interface Preference**

Path: Configuration Manager > Protocols > IP > Router Discovery
Default: 0
Options: A numeric value
Function: Specifies the preferability (a higher number indicates more preferred) of the address as a default router address, relative to other router addresses on the same subnet.
Instructions: Enter a value indicating the relative preferability of the router address. Enter a preference value of 0x80000000 to indicate to neighboring hosts that the address is not to be used as a default route.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.17.1.9

# OSPF Parameters


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## OSPF Global Parameters

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > OSPF > Global

Default: Enable

Options: Enable | Disable

Function: Globally enables or disables OSPF on all router interfaces.

Instructions: Set to Disable if you want to disable OSPF for the entire router. Set to Enable if you previously disabled OSPF on the router and now want to reenable it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.2

**Parameter: Router ID**

Path: Configuration Manager > Protocols > IP > OSPF > Global

Default: The IP address of the first OSPF circuit configured on this router

Options: Any IP address; preferably, one of the router's IP interface addresses

Function: This IP address uniquely identifies this router in the OSPF domain. By convention, and to ensure uniqueness, one of the router's IP interface addresses should be used as the router ID. The router ID will determine the designated router on a broadcast link if the priority values of the routers being considered are equal. The higher the router ID, the greater its priority.

Instructions: Enter the appropriate IP address in dotted-decimal notation. If both OSPF and BGP are running on the router, the OSPF router ID must be identical to the BGP identifier. In addition, the OSPF router ID must match one of the IP addresses configured on the router.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.4

**Parameter: AS Boundary Router**

Path: Configuration Manager > Protocols > IP > OSPF > Global

Default: No

Options: Yes | No

Function: Indicates whether or not this router functions as an AS boundary router. Only AS boundary routers are allowed to convert non-OSPF routes into OSPF routes so that they can be passed along throughout the OSPF routing domain. The router can be an AS boundary router if one or more of its interfaces is connected to a non-OSPF network (for example, RIP, BGP, or EGP).

Instructions: Set this parameter to Yes if this router functions as an AS boundary router. Otherwise, accept the default value, No.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.7

**Parameter:** **Hold Down Timer**

Path: Configuration Manager > Protocols > IP > OSPF > Global

Default: 1 second

Options: 0 to 10 seconds

Function: Prevents the algorithm to compute a route from running more than once per holddown time. Its purpose is to free up the CPU. Note that a value of 0 means there is no holddown time.

Instructions: Either accept the default value of 1 second or enter a new value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.9

**Parameter:** **OSPF Slot**

Path: Configuration Manager > Protocols > IP > OSPF > Global

Default: All slots

Options: Any slot on the router

Function: Indicates which slots the OSPF soloist is eligible to run on. If the slot on which the OSPF soloist is running goes down, the router will attempt to run OSPF on another slot specified by this parameter.

Instructions: Select all of the appropriate slots. Use caution when selecting the slots on which OSPF may run. If you choose an empty slot, and it is the only slot you choose, OSPF will not run; if you choose a slot that becomes disabled, and it is the only slot you choose, OSPF will not restart.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.10

**Parameter:** **ASE Metric Support**

Path: Configuration Manager > Protocols > IP > OSPF > Global

Default: Disable

Options: Enable | Disable

Function: Causes the router to use the route weight as the OSPF metric in OSPF ASE Type 2 advertisements.

Instructions: Disable ASE metric support if the router is to interoperate with routers using an OSPF version earlier than Version 8.00. The new metric is not compatible with the earlier metric.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.11

**Parameter: Backup Enable**

Path: Configuration Manager > Protocols > IP > OSPF > Global
Default: Disable
Options: Enable | Disable
Function: Enables or disables the backup OSPF soloist's backup link state database. When the parameter is set to Disable, the OSPF backup soloist will not maintain a copy of the OSPF link state database.
Instructions: Select the default, Disable, if you do not want to back up the OSPF soloist.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.12

**Parameter: Primary Log Mask**

Path: Configuration Manager > Protocols > IP > OSPF > Global
Default: Trace | Info | Debug | INTF state | NBR state | Bad LS
Options: Trace | Info | Debug | INTF state | NBR state | LSA self-origin | LSA receipt | Route change | Bad LS | Less recent LSA | More recent LSA | Max age LSA
Function: Specifies which OSPF log messages should be logged in the primary log.
Instructions: Highlight the line entry for Primary Log Mask in the Edit OSPF Global Parameters window and click on Values. Choose the log messages that you want to enter into the primary log by clicking on their buttons. Then click on OK.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.13

**Parameter: Backup Log Mask**

Path: Configuration Manager > Protocols > IP > OSPF > Global
Default: Log no messages
Options: Trace | Info | Debug | INTF state | NBR state | LSA self-origin | LSA receipt | Route change | Bad LS | Less recent LSA | More recent LSA | Max age LSA
Function: Specifies which OSPF log messages should be logged in the backup log.
Instructions: Highlight the line entry for Backup Log Mask in the Edit OSPF Global Parameters window and click on Values. Choose the log messages that you wish to enter into the backup log by clicking on their buttons. Then click on OK.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.14

**Parameter:** **Tag Generation Method**

Path: Configuration Manager > Protocols > IP > OSPF > Global

Default: Zero

Options: Zero │ Autotag │ Proprietary

Function: Specifies the method of OSPF external tag field generation.

Instructions: Set the parameter to Autotag if you want OSPF to generate a tag value according to RFC 1403, *OSPF/BGP Interaction*. Use the default to insert 0 into the tag field. The Proprietary option is reserved for debugging purposes.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.15

**Parameter:** **Multicast Extensions**

Path: Configuration Manager > Protocols > IP > OSPF > Global

Default: 0

Options: 0 (no multicast forwarding is enabled) │ 1 (intra-area multicasting only) │ 3 (intra-area and inter-area multicasting) │ 5 (intra-area and inter-AS multicasting) │ 7 (multicasting everywhere)

Function: Indicates whether the router is forwarding IP multicast (Class D) datagrams based on the algorithms defined in the Multicast Extensions to OSPF.

Instructions: Set the bitmask as required.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.19

**Parameter:** **Multicast Deterministic**

Path: Configuration Manager > Protocols > IP > OSPF > Global

Default: Nondeterministic

Options: Nondeterministic │ Deterministicstrict │ Deterministicloose

Function: Controls whether or not the deterministic variation of the MOSPF Dykstra is run.

Instructions: Select the appropriate variation of the Dykstra algorithm.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.20

**Parameter: Multicast Route Pinning**

Path: Configuration Manager > Protocols > IP > OSPF > Global
Default: Nonpinned
Options: Nonpinned │ Pinned
Function: Controls whether the route pinning variation of the MOSPF Dykstra is run.
Instructions: Select the appropriate variation of the Dykstra algorithm.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.21

**Parameter: Opaque Capability**

Path: Configuration Manager > Protocols > IP > OSPF > Global
Default: Enabled
Options: Enabled │ Disabled
Function: Controls whether or not OSPF accepts and processes OPAQUE LSAs.
Instructions: Select Disable if you do not want OSPF to accept OPAQUE LSAs.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.22

**Parameter: Deterministic Mcast Hold Down**

Path: Configuration Manager > Protocols > IP > OSPF > Global
Default: Disabled
Options: Enabled │ Disabled
Function: Controls whether the Hold Down feature for the Deterministic MOSPF is enabled.
Instructions: Enable this feature if you want a data flow to go out an interface only if there is a reservation for the flow on the interface.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.23

| | |
|---|---|
| **Parameter:** | **Timeout Value** |
| Path: | Configuration Manager > Protocols > IP > OSPF > Global |
| Default: | 600 seconds |
| Options: | An integer |
| Function: | Specifies a timer value for timing out MOSPF forward entries. |
| Instructions: | Use the default setting. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.3.1.24 |

| | |
|---|---|
| **Parameter:** | **RFC 1583 Compatibility** |
| Path: | Configuration Manager > Protocols > IP > OSPF > Global |
| Default: | Enabled |
| Options: | Enabled \| Disabled |
| Function: | Controls the preference rules used when choosing among multiple AS-external LSAs advertising the same destination. |
| Instructions: | Set this parameter to Enabled to use the preference rules specified by RFC 1583. Set this parameter to Disabled to use the preference rules specified in RFC 2178, which prevent routing loops when AS-external LSAs for the same destination originate from different areas. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.3.1.25 |

## OSPF Interface Parameters

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces

Default: Enable

Options: Enable | Disable

Function: This parameter indicates whether or not OSPF is enabled on this interface. The default value, Enable, indicates that neighbor relationships may be formed on this interface, and that this interface will be advertised as an internal route to some area. The value Disable indicates that this is not an OSPF interface.

Instructions: Set this parameter to Disable if you do not want OSPF enabled on the interface. Set it to Enable if you previously disabled OSPF on this interface and now wish to reenable it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.5.1.2

**Parameter: Area Address**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces

Default: 0.0.0.0

Options: Any 4-octet number in dotted-decimal notation

Function: This parameter identifies the area to which this interface belongs.

Instructions: Enter the appropriate area ID in dotted-decimal notation. Area ID 0.0.0.0 is reserved for the backbone.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.5.1.6

**Parameter: Broadcast Type**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces

Default: Broadcast

Options: Broadcast │ NBMA (nonbroadcast multiaccess) │ Point-to-point │ Point-to-multipoint (STD) │ Point-to-multipoint │ Passive

Function: Indicates the type of network to which this interface is attached. Choose Broadcast if this network is a broadcast LAN, such as Ethernet. Choose NBMA if the network is a nonbroadcast network, such as X.25. Choose Point-to-point for a synchronous, point-to-point interface. Choose Point-to-multipoint (STD) if the network is a point-to-multipoint network. If you want to use the Bay Networks proprietary solution for frame relay point-to-multipoint networks, select Point-to-multipoint. Choose passive to configure an interface that OSPF cannot use to form neighbor relationships. OSPF cannot accept hello messages or send advertisements on the passive interface.

Instructions: Set this parameter to match this interface type. If you set this parameter to NBMA, you need to configure neighbors manually.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.5.1.7

**Parameter: Rtr Priority**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces

Default: 1

Options: 0 to 255

Function: Indicates the priority of this interface. The router priority value is used in multiaccess networks (broadcast, NBMA, or point-to-multipoint), for the election of the designated router. If this parameter is set to 0, this router is not eligible to become the designated router on this particular network. In the case of equal Rtr Priority values, the router ID will determine which router will become the designated router. However, if there already is a designated router on the network when you start this router, it will remain the designated router no matter what your priority or router ID.

Instructions: Set the router priority to a value from 0 to 255 or accept the default value, 1.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.5.1.8

**Parameter: Transit Delay**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > OSPF > Interfaces |
| Default: | 1 second |
| Options: | 1 to 3,600 seconds |
| Function: | Indicates the estimated number of seconds it takes to route a packet over this interface. |
| Instructions: | Either accept the default value of 1 second or enter some slightly higher number for slower-speed serial lines, for example, 15 to 20 seconds for a 19.8-KB line. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.3.5.1.9 |

**Parameter: Retransmit Interval**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > OSPF > Interfaces |
| Default: | 5 seconds |
| Options: | 1 to 3,600 seconds |
| Function: | Indicates the number of seconds between link-state advertisement retransmissions for adjacencies belonging to this interface. This value is also used when retransmitting OSPF packets. Although the default value is 5, Bay Networks suggests the following values for this parameter: for broadcast, 5 seconds; for point-to-point, 10 seconds; for NBMA, 10 seconds; for point-to-multipoint, 10 seconds. |
| Instructions: | Either accept the default value of 5 seconds or set the retransmit interval to some slightly higher number for slower-speed serial lines. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.3.5.1.10 |

**Parameter: Hello Interval**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > OSPF > Interfaces |
| Default: | 10 seconds |
| Options: | 1 to 65,535 seconds |
| Function: | Indicates the number of seconds between the hello packets that the router sends on the interface. Although the default value is 10 seconds, Bay Networks suggests the following values for this parameter: for broadcast, 10 seconds; for point-to-point, 15 seconds; for NBMA, 20 seconds; for point-to-multipoint, 15 seconds. |
| Instructions: | Either accept the default value of 10 seconds or set the hello interval to some higher number for slower-speed serial lines. This value must be the same for all routers attached to the same network. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.3.5.1.11 |

**Parameter: Dead Interval**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > OSPF > Interfaces |
| Default: | 40 seconds |
| Options: | 1 to 2,147,483,647 seconds |
| Function: | Indicates the number of seconds that a router's hello packets have not been seen before its neighbors declare the router down. The dead interval value should be some multiple of the hello interval value. Bay Networks suggests the following values for this parameter: for broadcast, 40 seconds; for point-to-point, 60 seconds; for NBMA, 80 seconds; for point-to-multipoint, 60 seconds. |
| Instructions: | Either accept the default value of 40 seconds or set the dead interval to some higher number for slower-speed serial lines. This value must be the same for all routers attached to the same network |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.3.5.1.12 |

**Parameter: Poll Interval**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces

Default: 120 seconds

Options: 1 to 2,147,483,647 seconds

Function: Indicates the largest number of seconds allowed between hello packets sent to an inactive nonbroadcast multiaccess neighbor.

Instructions: Either accept the default value of 120 seconds or set this parameter to some slightly higher number for slower-speed serial lines.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.5.1.13

**Parameter: Metric Cost**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces

Default: 1

Options: 1 to 65,535

Function: Indicates the cost of using this type of service on this interface. Bay Networks suggests the following values for this parameter: for > = 100 Mb/s, 1; for Ethernet/802.3, 10; for E1, 48; for T1, 65; for 64 Kb/s, 1562; for 56 Kb/s, 1785; for 19.2 Kb/s, 5208; for 9.6 Kb/s, 10416. This parameter allows you to configure preferred paths. If you do want to configure a preferred path, allow that path to retain the default value of 1 or assign it a relatively low metric cost. Then, assign the less preferred paths a higher metric cost value.

Instructions: Either accept the default value, 1, or enter a larger number for a slower path or a backup route.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.5.1.16

**Parameter: Password**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces

Default: None

Options: Any ASCII string up to eight characters long

Function: Specifies the password used for this area. You can specify a password up to eight ASCII characters in length that will appear in the authentication field of all OSPF packets across this interface. This parameter is valid only when Authentication Type is set to Simplepassword.

Instructions: Enter the appropriate password. All routers in the same area must either have no authentication or have the same password.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.5.1.17

**Parameter: MTU Size**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces

Default: 1

Options: 1 | 2 | a number up to 10,000

Function: Specifies the maximum transmission unit (MTU) size of OSPF updates on this interface.

Instructions: Accept the default value, 1, to use the IP MTU size for that physical interface. Enter 2 to send packets no larger than the IP MTU size for Ethernet (1,500). Enter a number up to 10,000 to specify an MTU size directly; the number you enter must be less than the IP MTU size for that physical interface. When running OSPF over a synchronous/PPP link, set the MTU size to a value less than the sync MTU size (1,200). This allows all OSPF routes to be learned over the link.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.5.1.29

**Parameter: Multicast Forwarding**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces

Default: Blocked

Options: Blocked │ Multicast │ Unicast

Function: Specifies the way multicasts should be forwarded on this interface: not forwarded, forwarded as data link multicasting, or forwarded as data link unicasts. Data link multicasting is not meaningful on point-to-point and NBMA interfaces, and setting ospfMulticastForwarding to 0 effectively disables all multicast forwarding.

Instructions: If you configured MOSPF globally, specify the way you want IP to forward multicast packets on this interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.5.1.30

**Parameter: Opaque On**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces

Default: On

Options: On │ Off

Function: Controls whether or not OPAQUE LSAs are to be flooded out this interface

Instructions: If you have enabled the MOSPF opaque capability globally, you can turn it on and off on this interface as required.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.5.1.31

| | |
|---|---|
| **Parameter:** | **MTU Mismatch Detect Enable** |
| Path: | Configuration Manager > Protocols > IP > OSPF > Interfaces |
| Default: | Enabled |
| Options: | Enabled \| Disabled |
| Function: | Controls the interpretation of the MTU field in the database description packet header. According to RFC 2178, the MTU indicates the largest size IP packet that an OSPF interface can receive. If the MTU is greater than that which the interface can receive, the packet is ignored, and an adjacency is not formed. In RFC 1583 this field does not exist. |
| Instructions: | The value enabled denotes RFC2178 processing of the MTU field. The value disabled denotes RFC 1583 processing. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.3.5.1.34 |

## Neighbor Parameters for an NBMA Interface

| | |
|---|---|
| **Parameter:** | **Neighbor's IP Address** |
| Path: | Configuration Manager > Protocols > IP > OSPF > Interfaces > Neighbors > **Add** |
| Default: | None |
| Options: | IP address of neighbor |
| Function: | Indicates by IP address a nonbroadcast multiaccess neighbor for this interface. |
| Instructions: | Enter the appropriate IP address of the nonbroadcast multiaccess neighbor in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.3.7.1.4 |

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces > Neighbors

Default: Enable

Options: Enable | Disable

Function: Allows you to enable and disable this neighbor configuration for this interface. This parameter is useful if you want to temporarily disable a neighbor configuration rather than delete it.

Instructions: Set to Disable if you want to disable this neighbor configuration. Or set to Enable if you previously disabled this neighbor configuration and now want to reenable it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.7.1.2

**Parameter: Priority**

Path: Configuration Manager > Protocols > IP > OSPF > Interfaces > Neighbors

Default: 1

Options: 0 to 255

Function: Indicates the priority of this neighbor, with 255 indicating the highest priority. The neighbor priority value is used in multiaccess networks for the election of the designated router. If this parameter is set to 0, this router is not eligible to become the designated router on this particular network.

Instructions: Either accept the default neighbor priority value or enter some other value from 0 to 255.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.7.1.9

## OSPF Area Parameters

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > OSPF > Areas

Default: Enable

Options: Enable | Disable

Function: Allows you to enable and disable this area. This parameter is useful if you want to temporarily disable an area rather than delete it.

Instructions: Set this parameter to Disable if you want to disable this area. Set this parameter to Enable if you previously disabled the area and now want to reenable it. This will cause OSPF to restart.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.2

**Parameter: Authentication Type**

Path: Configuration Manager > Protocols > IP > OSPF > Areas

Default: None

Options: None | Simplepassword

Function: Enables or disables password authentication for the area. If you select Simplepassword (enabling password authentication), only those routers that share the correct password will be able to communicate with each other. If you accept the default, None, password authentication is disabled for this area.

Instructions: Either accept the default value, None, to disable password authentication or select Simplepassword to enable password authentication.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.5

**Parameter: Import AS Extern**

Path: Configuration Manager > Protocols > IP > OSPF > Areas

Default: Yes

Options: Yes | No

Function: Indicates whether or not this area imports AS external link-state advertisements. If this area does not import AS external link-state advertisements, it is a stub area. If it does import AS external link-state advertisements, it is not a stub area.

Instructions: Set to No if this area functions as a stub area. Otherwise, accept the default value, Yes.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.6

**Parameter: Stub Default Metric**

Path: Configuration Manager > Protocols > IP > OSPF > Areas

Default: 1

Options: 1 to 255

Function: When an area border router is connected to a stub area, it generates a default link summary into the area specifying a default route. The stub metric is the cost of that route. By default, Stub Metric equals 1. This parameter has meaning only when the Import AS Extern parameter is set to No.

Instructions: Either accept the stub metric default value, 1, or supply the appropriate Stub Metric value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.7

**Parameter: Cost for PtP Links**

Path: Configuration Manager > Protocols > IP > OSPF > Areas

Default: Enabled

Options: Enabled | Disabled

Function: Indicates the formula that OSPF uses to calculate the cost for a point-to-point link.

Instructions: Enable or disable cost calculation as required.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.1.10

## Area Range Parameters

**Parameter:** **Range Net**

Path: Configuration Manager > Protocols > IP > OSPF > Areas > **Ranges** > **Add**

Default: None

Options: Any network number

Function: Allows you to assign a single network address to a group of subnets. This network address, together with the subnet mask you provide, specifies the subnets to be grouped in this area range. Just one link summary advertisement will be generated for all subnets in this range, rather than one link summary advertisement for each of the subnets included in that network.

Instructions: Enter the appropriate network number in dotted-decimal notation.

MIB Object ID: 1.3.6.14.1.18.3.5.3.2.3.4.1.5

**Parameter:** **Range Mask**

Path: Configuration Manager > Protocols > IP > OSPF > Areas > **Ranges** > **Add**

Default: None

Options: Any address mask

Function: This parameter, together with Range Net, indicates all of the networks that belong to this range. The range mask is not restricted to the natural address class mask for the address supplied in the Range Net parameter.

Instructions: Enter the appropriate subnet mask in dotted-decimal notation.

MIB Object ID: 1.3.6.14.1.18.3.5.3.2.3.4.1.6

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > OSPF > Areas > **Ranges**
Default: Enable
Options: Enable | Disable
Function: Enables or disables this range for the specified area. This parameter is useful if you want to disable the range, rather than delete it.
Instructions: Set this parameter to Disable if you want to disable this range. Set the parameter to Enable if you previously disabled this range and now want to reenable it.
MIB Object ID: 1.3.6.14.1.18.3.5.3.2.3.4.1.2

**Parameter: Mask**

Path: Configuration Manager > Protocols > IP > OSPF > Areas > **Ranges**
Default: None
Options: Any address mask
Function: This parameter allows you to change the mask portion of this area range. Mask, together with Range Net, indicates all of the networks that belong to this range. Mask is not restricted to the natural address class mask for the address supplied in the Range Net parameter.
Instructions: Enter the appropriate address mask in dotted-decimal notation.
MIB Object ID: 1.3.6.14.1.18.3.5.3.2.3.4.1.6

**Parameter: Status**

Path: Configuration Manager > Protocols > IP > OSPF > Areas > **Ranges**
Default: Advertise
Options: Advertise | Do Not Advertise
Function: Specifies whether the border router advertises a summary route to other areas.
Instructions: Select Do Not Advertise if you want to hide the existence of certain networks from other areas. By default, the border router advertises a single route for the range of routes you specify.
MIB Object ID: 1.3.6.14.1.18.3.5.3.2.3.4.1.7

**Parameter:** **Metric**

Path: Configuration Manager > Protocols > IP > OSPF > Areas > **Ranges**

Default: 0

Options: 0 to 2,147,483,647

Function: Specifies the metric to advertise into other areas as the distance from the OSPF router to any network in the range.

Instructions: If you select 0, the router uses the value calculated by OSPF.

MIB Object ID: 1.3.6.14.1.18.3.5.3.2.3.4.1.8

## OSPF Virtual Interface Parameters

**Parameter:** **Enable**

Path: Configuration Manager > Protocols > IP > OSPF > Virtual Interfaces

Default: Enable

Options: Enable | Disable

Function: Enables or disables this virtual link. This parameter is useful when you want to temporarily disable a virtual link rather than delete it.

Instructions: Set to Disable to turn off this virtual link. Set to Enable if you previously disabled this virtual link and now want to reenable it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.7.1.2

**Parameter:** **Transit Delay**

Path: Configuration Manager > Protocols > IP > OSPF > Virtual Interfaces

Default: 1 second

Options: 1 to 360 seconds

Function: Indicates the estimated number of seconds it takes to transmit a link state update packet over this interface.

Instructions: Either accept the default value of 1 second or enter a new value from 1 to 360 seconds.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.7.1.6

**Parameter: Retransmit Interval**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > OSPF > Virtual Interfaces |
| Default: | 5 seconds |
| Options: | 1 to 360 seconds |
| Function: | Indicates the number of seconds between link-state advertisement retransmissions for adjacencies belonging to this interface. This value is also used when retransmitting database description and link-state request packets. This value should be well over the expected round-trip time. Although the default value is 5, Bay Networks suggests the following values for this parameter: for broadcast, 10 seconds; for point-to-point, 15 seconds; for NBMA, 15 seconds; for point-to-multipoint, 15 seconds. |
| Instructions: | Either accept the default value of 5 seconds or set the retransmit interval to some other value from 1 to 360 seconds. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.3.7.1.7 |

**Parameter: Hello Interval**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > OSPF > Virtual Interfaces |
| Default: | 15 seconds |
| Options: | 1 to 360 seconds |
| Function: | Indicates the number of seconds between the hello packets that the router sends on the interface. Although the default value is 15 seconds, Bay Networks suggests the following values for this parameter: for broadcast, 10 seconds; for point-to-point, 15 seconds; for NBMA, 20 seconds, for point-to-multipoint, 15 seconds. |
| Instructions: | Either accept the default value of 15 seconds or set the Hello Interval parameter to some other value from 1 to 360 seconds. This value must be the same for the virtual neighbor and for all routers attached to the same network. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.3.7.1.8 |

**Parameter: Dead Interval**

Path: Configuration Manager > Protocols > IP > OSPF > Virtual Interfaces

Default: 60 seconds

Options: 1 to 2,000 seconds

Function: Indicates the number of seconds that a router's hello packets have not been seen before its neighbors declare the router down. This value should be some multiple of the hello Interval. Although the default value is 60 seconds, Bay Networks suggests the following values for this parameter: for broadcast, 40 seconds; for point-to-point, 60 seconds; for NBMA, 80 seconds; for point-to-multipoint, 60 seconds.

Instructions: Either accept the default value of 60 seconds, or enter some other value for this parameter. This value must be the same for all routers attached to the same network.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.7.1.9

**Parameter: Password**

Path: Configuration Manager > Protocols > IP > OSPF > Virtual Interfaces

Default: None

Options: Any ASCII text string up to eight characters long

Function: Specifies the password used for this area. You can specify a password up to eight ASCII characters in length that will appear in the authentication field of all OSPF packets across this interface. Password is valid only when Authentication Type is set to Simplepassword.

Instructions: Enter the appropriate password. All routes in the same area must either have no authentication or have the same password.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.3.7.1.10

## RIP Parameters

| | |
|---|---|
| **Parameter:** | **Enable** |
| Path: | Configuration Manager > Protocols > IP > RIP > Interfaces |
| Default: | Enable |
| Options: | Enable \| Disable |
| Function: | Specifies whether the Routing Information Protocol (RIP) is enabled on this interface. |
| Instructions: | Select Enable to enable RIP on this interface. Select Disable to disable RIP on this interface. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.2.2.1.2 |

| | |
|---|---|
| **Parameter:** | **RIP Supply** |
| Path: | Configuration Manager > Protocols > IP > RIP > Interfaces |
| Default: | Enable |
| Options: | Enable \| Disable |
| Function: | Specifies whether the interface transmits periodic RIP updates to neighboring networks. |
| Instructions: | Select Enable to configure the interface to transmit RIP updates. Select Disable to prohibit the interface from transmitting RIP updates. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.2.2.1.5 |

**Parameter: RIP Listen**

Path: Configuration Manager > Protocols > IP > RIP > Interfaces

Default: Enable

Options: Enable | Disable

Function: Specifies whether this interface listens to RIP updates from neighboring networks.

Instructions: Select Enable to configure this interface to listen to RIP updates and, thus, add received routing information to its internal routing table. If you select Enable, a configured policy can still prohibit the interface from updating its internal routing tables. Select Disable to configure the interface to ignore RIP updates from neighboring routers. Thus, the interface does not add received routing information to its internal routing table.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.2.2.1.6

**Parameter: Default Route Supply**

Path: Configuration Manager > Protocols > IP > RIP > Interfaces

Default: Disable

Options: Enable | Disable | Generate

Function: Specifies whether or not the interface advertises a default route in RIP updates sent to neighboring networks. When a router does not know the route of a particular address, it uses the default route as the destination. A configured policy can override this setting. This parameter is independent of the RIP Supply parameter.

Instructions: If you select Enable, RIP advertises the default route if it is present in the routing table -- that is, if you have statically included a default route in the table or if the router has learned the default route (0.0.0.0) dynamically. If you select Generate, RIP advertises a default route whether or not a default route is present in the routing table. (This parameter does not cause RIP to create a routing table entry for a default route; the route will not be visible in the routing table.)

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.2.2.1.7

**Parameter: Default Route Listen**

Path: Configuration Manager > Protocols > IP > RIP > Interfaces

Default: Disable

Options: Enable │ Disable

Function: Specifies whether or not IP adds default route information to its internal routing table.

Instructions: Select Enable to configure the RIP interface to listen for and potentially add the default route (0.0.0.0) information to its internal routing table. Note that you must also enable RIP Listen on this interface. A configured policy can override this setting. Select Disable to prohibit the RIP interface from adding the default route (0.0.0.0) information to its internal routing table.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.2.2.1.8

**Parameter: Poisoned Reverse**

Path: Configuration Manager > Protocols > IP > RIP > Interfaces

Default: Poisoned

Options: Poisoned │ Actual │ Split

Function: Specifies how the RIP interface advertises routes it learns from an adjacent network in periodic updates subsequently sent to that network.

Instructions: Select Poisoned to configure this RIP interface to implement poisoned reverse. When poisoned reverse is enabled, the RIP interface advertises routes to the adjacent network from which it has learned the routes. In RIP updates, RIP uses a hop count of RIP Network Diameter plus one, thus declaring the destination unreachable. Poisoned reverse can speed up the convergence of the network routing tables. Select Split to configure this RIP interface to implement a split horizon. When split horizon is enabled, the RIP interface omits routes learned from a neighbor in RIP updates subsequently sent to that neighbor. Select Actual to configure this RIP interface to advertise routes with the learned cost. This is useful on a frame relay interface that has virtual connections (VCs) to different routers that are part of the same logical IP subnet.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.2.2.1.9

**Parameter: Time to Live**

| | |
|---|---|
| Path | Configuration Manager > Protocols > IP > RIP > Interfaces |
| Default: | 1 |
| Options: | 1 to 255 hops |
| Function: | Specifies a TTL value to be inserted in the IP header for RIP updates. Certain RIP implementations ignore packets with a TTL value of 1 hop. Use this parameter to provide interoperability with such implementations. |
| Instructions: | Setting a TTL of 1 prevents RIP updates from inadvertently getting off the local network. Increasing the TTL introduces the risk of the update getting off the local network and being forwarded around the network. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.2.2.1.11 |

**Parameter: Broadcast Timer**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > RIP > Interfaces |
| Default: | 30 seconds; 1 hour for dial-optimized routing |
| Options: | 5 seconds to 86,400 seconds (24 hours); 1 hour to 1,209,600 seconds (2 weeks) for dial-optimized routing |
| Function: | Specifies how frequently RIP does a full update of the routing table. |
| Instructions: | Enter a value in 5-second increments. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.2.2.1.12 |

**Parameter: Timeout Timer**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > RIP > Interfaces |
| Default: | 90 seconds; 3 hours for dial-optimized routing |
| Options: | 15 seconds to 259,200 seconds (72 hours); 3 hours to 3,628,800 seconds (6 weeks) for dial-optimized routing |
| Function: | Specifies the time period that RIP will wait for an update for a particular network before declaring it to be unreachable. |
| Instructions: | Bay Networks recommends a timeout value of the broadcast time multiplied by 3. Enter a time in 5-second increments. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.2.2.1.13 |

| | |
|---|---|
| **Parameter:** | **Holddown Timer** |
| Path: | Configuration Manager > Protocols > IP > RIP > Interfaces |
| Default: | 90 seconds; 3 hours for dial-optimized routing |
| Options: | 15 seconds to 259,200 seconds (72 hours); 3 hours to 3,628,800 seconds (6 weeks) for dial-optimized routing |
| Function: | Specifies the time period that unusable routes will be advertised through this interface after the route has become invalid. |
| Instructions: | Bay Networks recommends a timeout value of the broadcast time multiplied by 3. Enter a time in 5-second increments. This parameter affects how long a route remains in the routing table after the route has become unusable. To guarantee the holddown time for each interface, RIP uses the largest holddown value as the amount of time to keep the route in the routing table. Please note that if a route to a destination becomes unusable, the holddown value will not affect the router's ability to learn new routes to the same destination. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.2.2.1.14 |

**Parameter: RIP Mode**

Path: Configuration Manager > Protocols > IP > RIP > Interfaces

Default: RIP I

Options: RIP I │ RIP II │ RIPII with aggregation

Function: Specifies which mode of RIP to run.

Instructions: If you specify RIP I, RIP generates RIP Version 1 packets only. The destination IP address is the directed broadcast address, and the destination MAC address is the broadcast address. Select RIP I if any of the listening devices are RIP Version 1-only devices. If you select RIP II, RIP generates RIP Version 2 updates with the destination MAC address set to the multicast address of 224.0.0.9 specified in the RIP Version 2 RFC. The destination MAC address on Ethernet and FDDI networks will be the corresponding multicast address. On all other media, the destination MAC address will be the broadcast address. RIP does not aggregate subnet information in the updates. If you select RIPII with aggregation, RIP generates Version 2 updates but aggregates subnet information in the manner of RIP Version 1. Bay Networks recommends using RIP II mode, with or without aggregation, rather than RIP I mode, especially if unnumbered point-to-point links or variable-length subnets are used.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.2.2.1.15

**Parameter: Triggered Updates**

Path: Configuration Manager > Protocols > IP > RIP > Interfaces

Default: Disable

Options: Enable │ Disable

Function: Configures RIP to generate an update each time it recalculates a route's metric.

Instructions: For compatibility with routers running Version 8.10 or earlier, disable this feature. Implementations of RIP earlier than Version 9.00 do not support triggered updates. If you enable triggered updates, RIP will generate triggered updates with a maximum frequency of one every 5 seconds. The route will include all changes that occurred in the last 5 seconds. This enforced interval prevents RIP from monopolizing CPU resources during periods of instability.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.2.2.1.16

**Parameter: Authentication Type**

Path: Configuration Manager > Protocols > IP > RIP > Interfaces
Default: None
Options: None │ Simple
Function: Specifies the way RIP handles simple authentication in RIP2 mode.
Instructions: If you are running RIP in RIP2 mode and do not want authentication, set this parameter to None. If you set the parameter to Simple, RIP drops all received Version 1 updates and processes only Version 2 updates with the correct password set.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.2.2.1.17

**Parameter: Authentication Password**

Path: Configuration Manager > Protocols > IP > RIP > Interfaces
Default: None
Options: A valid password string up to 16 characters
Function: Specifies a password.
Instructions: Set the Authentication Type to Simple and enter a password.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.2.2.1.18

**Parameter: Initial Stabilization Timer**

Path: Configuration Manager > Protocols > IP > RIP > Interfaces
Default: 120 seconds
Options: 0 to 86,400 seconds
Function: Specifies the interval that RIP uses as its initial stabilization period.
Instructions: Specify an interval that will allow RIP to learn all routes from its neighbors before sending a full routing update on the interface.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.2.2.1.19

# NAT Parameters

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > NAT > Global
Default: Enable
Options: Enable │ Disable
Function: Specifies whether NAT will perform network address translation.
Instructions: Set to Enable if you want to enable NAT on the entire router. Set to Disable to disable NAT.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.1.2

**Parameter: Soloist Slot Mask**

Path: Configuration Manager > Protocols > IP > NAT > Global
Default: All slots enabled (except for slot 1)
Options: Enable selected slots using bit mask
Function: Specifies the slots on which NAT can run as a soloist.
Instructions: Set the bits on the soloist slot mask by entering a 1 in the correct bit position in the mask. The leftmost bit represents the slot with the lowest number. For example, if a router has five slots, you can configure a slot mask to allow NAT to run as a soloist on slots 3 and 5 by entering the binary value 00101.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.1.4

**Parameter: Log Mask**

Path: Configuration Manager > Protocols > IP > NAT > Global
Default: All message types enabled
Options: Enable selected log message types using bit mask
Function: Specifies the types of log messages that are reported by NAT software.
Instructions: Set the bits on the log mask by entering a 1 in the correct bit position in the mask (bit position 0 is the rightmost bit).
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.1.6

**Parameter: Mapping Entry Timeout**

Path: Configuration Manager > Protocols > IP > NAT > Global

Default: Enable

Options: Enable │ Disable

Function: Enables or disables the mapping entry timeout feature for NAT. You can configure a global timeout period for dynamic mapping entries. If there have been no translated packets for a specific address mapping when the timer expires, NAT software removes the entry from the dynamic mapping entry list, thus freeing the global address for another mapping.

Instructions: Set to Enable if you want to enable the mapping entry timeout feature on the entire router. Set to Disable to disable the feature.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.1.7

**Parameter: Max Timeout**

Path: Configuration Manager > Protocols > IP > NAT> Global

Default: 3600 seconds

Options: 1 to 2,147,483,648 seconds

Function: Specifies the maximum timeout period for a dynamic mapping entry. If there have been no translated packets for a specific address mapping when the timer expires, NAT software removes the entry from the dynamic mapping entry list, thus freeing the global address for another mapping.

Instructions: Specify the timeout period.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.1.8

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > NAT > Interface

Default: Enable

Options: Enable │ Disable

Function: Enables or disables NAT on an IP interface.

Instructions: Set to Enable to enable NAT on an IP interface. Set to Disable to disable NAT on an IP interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.6.2

**Parameter: Interface Type**

Path: Configuration Manager > Protocols > IP > NAT > Interface

Default: Local

Options: Local │ Global

Function: Specifies the NAT interface type for a specific IP interface

Instructions: Set to Local to configure the interface so that NAT software processes traffic from within the network. When NAT detects a packet within an enabled local dynamic address range, it translates the local unregistered address to a global address.

Set to Global to configure the interface so that NAT software processes traffic that has been processed on a local NAT interface to its destination address outside the local network.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.6.1.5

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > NAT > Static

Default: Enable

Options: Enable │ Disable

Function: Enables or disables one-to-one mapping of an unregistered local address to a global address. Static address mapping does not time out during periods when there is no traffic on the interface. The mapping remains configured until you disable it.

Instructions: Set to Enable if you want to enable a configured local/global address pair in the static mapping list. Set to Disable if you want to disable mapping for a specific local/global address pair.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.4.1.2

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > NAT > Dynamic > Local

Default: Enable

Options: Enable | Disable

Function: Enables or disables a local address range in the NAT Local Address Range list. A NAT local address range is a range of local unregistered source addresses that you configure using the ADD button. See Chapter 12 for information about how to configure NAT local address ranges.

When NAT software detects a packet with an address in the local address range on a NAT local interface, and this feature is enabled for the range, NAT software maps the local address to a registered global address. NAT replaces the local address with the global address and sends the packet on a NAT global interface to its destination in an external network.

Instructions: Set to Enable to enable a dynamic mapping for a specific local address range. Set to Disable to disable dynamic mapping for a specific local address range.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.3.1.2

**Parameter: N-to-1 Address**

Path: Configuration Manager > Protocols > IP > NAT > Dynamic > Local

Default: 0

Options: A global IP address

Function: Enables NAT for N-to-1 address translation and specifies a global IP address

Instructions: To disable N-to-1 translation, use the default value, 0.

To enable N-to-1 translation and specify a global IP address, enter the global IP address. NAT translates any address in the local range to the global IP address.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.3.1.2

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > NAT > Dynamic > Global

Default: Enable

Options: Enable │ Disable

Function: Enables or disables a global address range in the NAT Global Address Range list. A NAT global address range is a range of registered source addresses that you configure using the ADD button. See Chapter 12 for information about how to configure NAT global address ranges.

NAT maps global addresses to unregistered local addresses for packets with destination addresses in an external network. NAT replaces the unregistered local address with a registered global address, and sends the packet to its destination in an external network.

Instructions: Set to Enable to enable a dynamic mapping for a specific local address range. Set to Disable to disable dynamic mapping for a specific local address range.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.7.2.1.5

# GRE Tunnel Configuration Parameters

**Parameter: Tunnel Name**

Path: Configuration Manager > Protocols > IP > GRE > **Add Tunnel**
Default: None
Options: Any name of up to 64 characters
Function: Identifies the GRE tunnel.
Instructions: Enter a name.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.27.1.5

**Parameter: IP Interface**

Path: Configuration Manager > Protocols > IP > GRE > **Add Tunnel**
Default: None
Options: IP interface address
Function: Specifies the IP address of the IP interface on which you are configuring the GRE tunnel.
Instructions: Enter the IP address of the appropriate local IP interface in dotted-decimal notation.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.27.1.7

**Parameter: Connection Name**

Path: Configuration Manager > Protocols > IP > GRE > **Remote Conn**
Default: Null
Options: Any name of up to 64 characters
Function: Identifies the remote connection.
Instructions: Enter the appropriate connection name.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.28.1.5

**Parameter: Remote Physical IP Address**

Path: Configuration Manager > Protocols > IP > GRE > **Remote Conn**
Default: 0.0.0.0
Options: IP interface address
Function: Specifies the IP address of the remote router interface that connects the remote router to the remote host.
Instructions: Either accept the default remote IP address, or enter a new IP address in dotted-decimal notation.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.28.1.6

**Parameter: Remote Logical IP Address**

Path: Configuration Manager > Protocols > IP > GRE > **Remote Conn**
Default: None
Options: IP interface address
Function: Identifies the IP address of the remote tunnel interface.
Instructions: Enter the appropriate IP address in dotted-decimal notation.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.6.1

**Parameter: Remote Logical IPX Address (hex)**

Path: Configuration Manager > Protocols > IP > GRE > **Remote Conn**
Default: None
Options: Valid host ID of the adjacent host
Function: Specifies the host ID of the adjacent host.
Instructions: Enter the appropriate host ID (up to 12 hexadecimal characters).
MIB Object ID: Not applicable.

# Appendix B
# Routing Policies


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# Common Accept Policy Parameters

| | |
|---|---|
| **Parameter:** | **Enable** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies |
| Default: | Enable |
| Options: | Enable \| Disable |
| Function: | Enables or disables this policy. |
| Instructions: | Set to Disable to disable the policy. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.1.1.2 |
| | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.3.1.2 |
| | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.5.1.2 |
| | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.2 |
| | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.2 |

| **Parameter:** | **Name** |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 >BGP-4 > Accept Policies |
| Default: | None |
| Options: | Any alphanumeric character string |
| Function: | Identifies this accept policy. |
| Instructions: | Specify a user name for the policy. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.1.1.4 |
| | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.3.1.4 |
| | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.5.1.4 |
| | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.4 |
| | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.4 |

| | |
|---|---|
| **Parameter:** | **Networks** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies |
| Default: | An empty list |
| Options: | A list of network identifiers. Each entry consists of a network number, a mask, and a flag to indicate whether the ID refers to a specific network or a range of networks. |
| Function: | Specifies the networks to which this policy applies. |
| Instructions: | Enter a specific encoding of 0.0.0.0/0.0.0.0 to match the default route. Enter a range encoding of 0.0.0.0/0.0.0.0 to match any route. Use the default empty list to match any route. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.1.1.5<br>OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.3.1.5<br>EGP: 1.3.6.1.4.1.18.3.5.3.2.6.5.1.5<br>BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.5<br>BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.5 |

| **Parameter:** | **Action** |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies |
| Default: | RIP, OSPF, EGP: Accept; BGP-3, BGP-4: Ignore |
| Options: | Accept \| Ignore |
| Function: | Specifies whether the protocol ignores a route that matches the policy or forwards the route to the routing table manager. |
| Instructions: | Specify Accept to consider the route for insertion in the routing table. To drop the route, specify Ignore. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.1.1.6 |
| | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.3.1.6 |
| | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.5.1.6 |
| | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.6 |
| | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.6 |

| | |
|---|---|
| **Parameter:** | **Route Preference** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies |
| Default: | 1 |
| Options: | 1 to 16 |
| Function: | Assigns a metric value (the higher the number, the greater the preference) to a route that the protocol forwards to the routing table manager. If confronted with multiple routes to the same destination, the routing table manager may need to use this value to decide which route to insert. |
| Instructions: | Either accept the default value, 1, or enter a new value. Routes for all networks (0.0.0.0/0.0.0.0) should have the lowest preference and routes for the most specific networks (longest address and mask) should have the highest preference. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.1.1.7<br>OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.3.1.7<br>EGP: 1.3.6.1.4.1.18.3.5.3.2.6.5.1.7<br>BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.7<br>BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.7 |

| | |
|---|---|
| **Parameter:** | **Rule Precedence** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies |
| Default: | 0 |
| Options: | A metric value |
| Function: | Assigns a metric value to this policy (a policy with a higher value takes precedence over a policy with a lower value). |
| Instructions: | Use this value to specify the order of precedence for policies that match the same route. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.1.1.8<br>OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.3.1.8<br>EGP: 1.3.6.1.4.1.18.3.5.3.2.6.5.1.8<br>BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.8<br>BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.8 |

# RIP-Specific Accept Policy Parameters

| | |
|---|---|
| **Parameter:** | **From Gateway** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Accept Policies |
| Default: | An empty list |
| Options: | A list of IP addresses |
| Function: | Specifies the addresses of one or more routers that could send RIP updates to this router. This policy applies to RIP advertisements from routers on this list. |
| Instructions: | Use the default empty list to indicate that this policy applies to RIP updates from any router. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.6.1.1.10 |

| | |
|---|---|
| **Parameter:** | **Received on Interface** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Accept Policies |
| Default: | An empty list |
| Options: | A list of IP addresses |
| Function: | Specifies the IP addresses of one or more interfaces on this router. This policy applies to RIP updates received on interfaces that appear on this list. |
| Instructions: | Use the default empty list to indicate that this policy applies to RIP updates received on any interface. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.6.1.1.11 |

**Parameter:** **Apply Subnet Mask**

Path: Configuration Manager > Protocols > IP > Policy Filters > RIP > Accept Policies

Default: Null

Options: Null or IP address mask

Function: Specifies a mask that will override the interface's subnet mask in the presence of networks with variable-length subnet masks.

Instructions: Supply a mask, set the Action parameter to Accept, and use the default Network parameter (an empty list). If you specify a mask of 0.0.0.0, the router determines which mask to apply. For example, if the network in the update is a subnet of the same network as the receiving interface, the router applies the mask of the receiving interface. If the network in the update is a subnet of a different natural network, the router applies the natural mask of that network.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.1.1.12

## OSPF-Specific Accept Policy Parameters

**Parameter:** **Type**

Path: Configuration Manager > Protocols > IP > Policy Filters > OSPF > Accept Policies

Default: Any

Options: Type 1 | Type 2 | Any

Function: Describes which types of OSPF ASE routes match this policy.

Instructions: To match either Type 1 or Type 2, use the default, Any.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.3.1.10

| | |
|---|---|
| **Parameter:** | **Tag** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Accept Policies |
| Default: | An empty list |
| Options: | A list of tag values |
| Function: | Specifies OSPF tag values that could be present in an OSPF ASE advertisement. This policy applies to OSPF ASE advertisements that contain the tag values on this list. |
| Instructions: | Use the default empty list to indicate that this policy applies to OSPF ASE advertisements with any tag value. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.6.3.1.11 |

## EGP-Specific Accept Policy Parameters

| | |
|---|---|
| **Parameter:** | **Peer List** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Accept Policies |
| Default: | An empty list |
| Options: | A list of IP addresses |
| Function: | Specifies the IP addresses of one or more EGP peers. This policy applies to EGP advertisements from the peers on this list. |
| Instructions: | Use the default empty list to indicate that this policy applies to EGP advertisements from any EGP peer. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.6.5.1.10 |

**Parameter: AS List**

Path: Configuration Manager > Protocols > IP > Policy Filters > EGP > Accept Policies

Default: An empty list

Options: A list of autonomous system numbers

Function: Specifies one or more autonomous system numbers. This policy applies to EGP advertisements from peers located in the autonomous systems on this list.

Instructions: Use the default empty list to indicate that this policy applies to EGP advertisements from peers in any AS.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.5.1.11

**Parameter: Gateway List**

Path: Configuration Manager > Protocols > IP > Policy Filters > EGP > Accept Policies

Default: An empty list

Options: A list of IP addresses

Function: Specifies the IP address of one or more EGP gateways. This policy applies to EGP advertisements that use these gateways as the next hop.

Instructions: Use the default empty list to indicate that this policy applies to EGP advertisements with any gateway address.

MIB Object ID: EGP: 1.3.6.1.4.1.18.3.5.3.2.6.5.1.12

# BGP-3-Specific Accept Policy Parameters

| | |
|---|---|
| **Parameter:** | **Injection List** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies |
| Default: | An empty list |
| Options: | A list of network identifiers |
| Function: | Specifies network IDs to be included in the routing table in place of the network IDs listed in the received advertisement. |
| Instructions: | Specify a non-null value only if the Action parameter is set to Accept. The values you enter in the injection list determine the action taken. If you supply a list of network IDs, these IDs are injected into the routing table instead of the actual received IDs.<br><br>If you use the default (an empty list), the actual received network IDs are injected into the routing table.<br><br>If you supply a list that includes the encoding 255.255.255.255/ 255.255.255.255, the actual received network IDs are injected into the routing table along with the other IDs in the injection list. This allows insertion of an aggregate or default along with the actual networks.<br><br>The only valid network ID that you can include in an injection list is the default ID, 0.0.0.0/0.0.0.0. This parameter replaces the received routes with the default route and places the default route in the routing table. This parameter associates the default route with the attributes of the best route that matches the policy.<br><br>If you are constructing a BGP-3 or BGP-4 accept policy, keep in mind that this parameter does not perform route aggregation as defined in RFC 1654. To aggregate routes in a transit AS, you must construct an announce policy and use the announce Advertise parameter. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.6.7.1.9 |

**Parameter: Peer AS**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies

Default: An empty list

Options: A list of autonomous system numbers, each ranging from 1 to 65,536

Function: Specifies one or more autonomous systems. This policy applies to BGP advertisements from peers in those ASs.

Instructions: Use the default empty list to indicate that this policy applies to BGP advertisements from peers in any AS.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.10

**Parameter: Peer Address**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies

Default: An empty list

Options: A list of IP addresses

Function: Specifies one or more BGP peers. This policy applies to BGP advertisements from the peers on this list.

Instructions: To indicate that this policy applies to BGP advertisements from any BGP peer, use the default empty list.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.11

**Parameter: Originating AS**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies

Default: An empty list

Options: A list of autonomous system numbers

Function: Specifies one or more autonomous systems. This policy applies to BGP advertisements that originate from the ASs on this list.

Instructions: To indicate that the policy applies to BGP advertisements originating from any AS, use the default empty list.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.12

**Parameter: Route Origin**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies

Default: Any

Options: Any │ IGP │ EGP │ IGP or EGP │ Incomplete │ Incomplete or IGP │ Incomplete or EGP

Function: Specifies the values of the BGP origin path attribute that apply to this policy.

Instructions: Select the origin values you want to accept for this policy.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.13

**Parameter: BGP-3 Route Preference**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies

Default: 1

Options: 1 to 16

Function: Specifies a value that is used to compare a route that matches this policy with other BGP-3 routes that match the policy. The larger the value, the greater the preference.

Instructions: To specify maximum preference, enter 16. This parameter is valid only if the Action parameter is set to Accept.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.14

**Parameter: AS Weight Class**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies

Default: Weight class 1

Options: Weight class 1 to weight class 8

Function: Indicates which weight class should be used when calculating the AS path weight.

Instructions: Set the Action parameter to Accept and supply a valid BGP-3 weight class.

MIB Object ID: BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.15

| **Parameter:** | **Community Match** |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Accept Policies |
| Default: | An empty list |
| Options: | A list of BGP communities |
| Function: | Specifies one or more BGP communities. This policy applies to all BGP advertisements that match the list. |
| Instructions: | Supply an octet string using the following format: each community ID is 4 bytes long; 0 in the two most significant bits causes the router to perform the match on the lower 16 bits; the default empty list means match any list. |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.7.1.16 |

# BGP-4-Specific Accept Policy Parameters

| | |
|---|---|
| **Parameter:** | **Injection List** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies |
| Default: | An empty list |
| Options: | A list of network identifiers |
| Function: | Specifies network IDs to be included in the routing table in place of the network IDs listed in the received advertisement. |
| Instructions: | Specify a non-null value only if the Action parameter is set to Accept. The values you enter in the injection list determine the action taken.<br><br>If you supply a list of network IDs, these IDs are injected into the routing table instead of the actual received IDs.<br><br>If you use the default (an empty list), the actual received network IDs are injected into the routing table. If you supply a list that includes the encoding 255.255.255.255/255.255.255.255, the actual received network IDs are injected into the routing table along with the other IDs in the injection list. This allows insertion of an aggregate or default along with the actual network.<br><br>The only valid network ID that you can include in an injection list is the default ID, 0.0.0.0/0.0.0.0. This parameter replaces the received routes with the default route and places the default route in the routing table. This parameter associates the default route with the attributes of the best route that matches the policy.<br><br>If you are constructing a BGP-3 or BGP-4 accept policy, keep in mind that the Injection List parameter does not perform route aggregation as defined in RFC 1654. To aggregate routes in a transit AS, you must construct an announce policy and use the announce Advertise parameter. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.6.9.1.9 |

**Parameter: Peer AS**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: An empty list

Options: A list of autonomous system numbers, each ranging from 1 to 65,536

Function: Specifies one or more ASs. This policy applies to BGP advertisements from peers in the autonomous systems on this list.

Instructions: Use the default empty list to indicate that this policy applies to BGP advertisements from peers in any AS.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.10

**Parameter: Peer Address**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: An empty list

Options: A list of IP addresses

Function: Specifies one or more BGP peers. This policy applies to BGP advertisements from the peers on this list.

Instructions: To indicate that this policy applies to BGP advertisements from any BGP peer, use the default empty list.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.11

**Parameter: Originating AS**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: An empty list

Options: A list of autonomous system numbers

Function: Specifies one or more autonomous systems. This policy applies to BGP advertisements that originate from the ASs on this list.

Instructions: To indicate that the policy applies to BGP advertisements originating from any AS, use the default empty list.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.12

**Parameter: Route Origin**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: Any

Options: Any │ IGP │ EGP │ IGP or EGP │ Incomplete │ Incomplete or IGP │ Incomplete or EGP

Function: Specifies which values of the BGP origin attribute apply to this policy.

Instructions: Select the origin values you wish to accept for this policy.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.13

**Parameter: Aggregator AS List**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 >BGP-4 > Accept Policies

Default: An empty list

Options: A list of AS numbers

Function: Specifies one or more autonomous systems. This policy applies to BGP advertisements that contain in their Aggregator path attribute an AS number on this list.

Instructions: To specify that the policy applies to BGP advertisements with any AS number in the Aggregator path attribute, use the default empty list.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.14

**Parameter: Aggregator Router List**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: An empty list

Options: A list of IP addresses

Function: Specifies one or more BGP routers. This policy applies to BGP advertisements that contain in their Aggregator path attribute an IP address on this list.

Instructions: To specify that this policy applies to BGP advertisements with any router address in the Aggregator path attribute, use the default empty list.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.15

**Parameter: Local Preference**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: 0

Options: 0 to 4,294,967,295

Function: Assigns a local preference value to a route matching this policy. This value overrides the calculated value for EBGP routes or the Local Preference path attribute for IBGP routes.

Instructions: To indicate a preference, enter a value from 1 to 4,294,967,295.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.16

**Parameter: BGP-4 Preference**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: 1

Options: 1 to 16

Function: Specifies a value that can be used to compare a route that matches this policy with other BGP-4 routes. The larger the value, the greater the preference.

Instructions: To indicate maximum preference, enter 16. This parameter is valid only if the Action parameter is set to Accept.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.17

**Parameter: AS Weight Class**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: Weight class 1

Options: Weight class 1 to weight class 8

Function: Indicates which weight class value should be used when calculating the AS path weight.

Instructions: Enter a valid BGP-4 weight class. This parameter is valid only if the Action parameter is set to Accept.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.18

**Parameter: AS Pattern**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: Empty string

Options: Any regular expression or empty string

Function: Allows AS_PATH pattern matching

Instructions: Enter a valid regular expression to indicate an AS and its position in a path. The policy applies to all routes whose AS path includes the AS in that position. For example, the expression * 200 $ means that the policy applies to all routes whose AS_PATH attribute contains AS 200 as the last AS in the path.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.19

**Parameter: BGP Communities to Match**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: An empty list

Options: A list of BGP communities

Function: Specifies one or more BGP communities. This policy applies to all BGP advertisements that match the list.

Instructions: Supply an octet string using the following format: each community ID is 4 bytes long; 0 in the two most significant bits causes the router to perform the match on the lower 16 bits; the default empty list means “match any list.”

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.20

**Parameter: Route Flap Dampening**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: Enable

Options: Enable │ Disable

Function: Enables or disables route flap dampening on this accept policy.

Instructions: To enforce route flap dampening on the routes specified by this accept policy, set this parameter to Enable; otherwise, accept the default, Disable.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.26

**Parameter: Route Flap Dampening Template**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies

Default: default (when the Route Flap Dampening parameter is set to Enable)

Options: Name of a configured route-flap-dampening template

Function: Specifies the name of the configured route-flap-dampening template to apply to the routes specified by this accept policy.

Instructions: Enter the name of a configured route flap dampening template, or accept the default template.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.9.1.27

**Parameter: Name**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies > Route Flap

Default: None

Options: An alphanumeric string up to 20 characters

Function: Identifies the name of the route flap dampening template.

Instructions: Enter a string that uniquely identifies the route flap dampening template.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.8.1.3

**Parameter: Cutoff Threshold**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies > Route Flap

Default: 2000

Options: 1 to 20000

Function: Specifies the maximum threshold for the route penalty value. If the penalty value rises above the value for this parameter, BGP suppresses the route. The router increments the penalty value by 1000 for each withdrawal and increments it by 500 for each reachable announcement.

Instructions: Enter a number for the cutoff penalty value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.8.1.4

**Parameter: Reuse Threshold**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies > Route Flap

Default: 750

Options: 1 to 20000

Function: Specifies the minimum threshold for the route penalty value. If the penalty value falls below the value you enter for this parameter, BGP no longer suppresses the route. The penalty value decreases over time based on the values you set for the Reachable Decay and Unreachable Decay parameters.

Instructions: Enter a number for the reuse penalty value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.8.1.5

**Parameter: Reachable Decay**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies > Route Flap

Default: 5

Options: 1 to 45 minutes

Function: Specifies the amount of time, in minutes, before BGP decrements the penalty value of a reachable route by half. BGP uses a half-life decay algorithm to decrement the penalty value.

Instructions: Enter a value for the half-life decay for reachable routes.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.5.1.8.1.6

**Parameter: Unreachable Decay**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies > Route Flap |
| Default: | 15 |
| Options: | 1 to 45 minutes |
| Function: | Specifies the amount of time, in minutes, before BGP decrements the penalty value of an unreachable route by half. BGP uses a half-life decay algorithm to decrement the penalty value. |
| Instructions: | Enter a value for the half-life decay for an unreachable route. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.8.1.7 |

**Parameter: Max HoldDown**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies > Route Flap |
| Default: | 45 |
| Options: | 1 to 60 minutes |
| Function: | Specifies the maximum amount of time that a route can remain suppressed. If the route remains suppressed after the number of minutes you specify, BGP unsuppresses it, even if the penalty value exceeds the threshold. |
| Instructions: | Enter the maximum amount of time, in minutes, that the route should be suppressed. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.8.1.8 |

| | |
|---|---|
| **Parameter:** | **Memory Limit** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Accept Policies > Route Flap |
| Default: | 45 |
| Options: | 1 to 60 minutes |
| Function: | Specifies the maximum amount of time that the status of a route can remain unchanged, reachable or unreachable, before BGP unsuppresses the route. If the status of the route remains unchanged, after the number of minutes you specify, BGP unsuppresses the route and sets the penalty value to 0. |
| Instructions: | Enter the maximum amount of time, in minutes, that the status of a route can remain unchanged, reachable or unreachable.<br><br>If the status of the route remains unchanged for the specified number of minutes, BGP resets the penalty value and flap count to 0. If the route is currently suppressed, BGP unsuppresses it. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.5.1.8.1.9 |

## Common Announce Policy Parameters

| | |
|---|---|
| **Parameter:** | **Enable** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | Enable |
| Options: | Enable \| Disable |
| Function: | Enables or disables this policy. |
| Instructions: | Set to Disable to disable the policy. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.2 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.2 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.2 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.2 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.2 |

| **Parameter:** | **Name** |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | None |
| Options: | Any alphanumeric character string |
| Function: | Identifies this policy. |
| Instructions: | Enter a unique name for the policy. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.4 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.4 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.4 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.4 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.4 |

**Parameter: Networks**

Path: Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: An empty list

Options: A list of network identifiers. Each identifier consists of a network number, a mask, and a flag to indicate whether the ID refers to a specific network or a range of networks

Function: Specifies which networks will match this policy.

Instructions: Enter a specific encoding of 0.0.0.0/0.0.0.0 to match the default route. Enter a range encoding of 0.0.0.0/0.0.0.0 to match any route. Enter an empty list to match any route.

MIB Object ID: RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.5

MIB Object ID: OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.5

MIB Object ID: EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.5

MIB Object ID: BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.5

MIB Object ID: BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.5

| Parameter: | Action |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | RIP, OSPF, EGP: Propagate; BGP-3, BGP-4: Ignore |
| Options: | Propagate \| Ignore |
| Function: | Specifies whether or not to advertise a route that matches this policy. |
| Instructions: | To advertise the route, specify Propagate. To drop the route, specify Ignore. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.6 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.6 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.6 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.6 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.6 |

**Parameter: Rule Precedence**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | 0 |
| Options: | A metric value |
| Function: | Specifies a metric value to be used to compare this policy with other policies that a route may match. A policy with a higher metric takes precedence over a policy with a lower metric. In case of a tie, the protocol uses an internal index value assigned to the policy by IP software. (In general, the index value is indicated by the position of the policy in the Site Manager display -- the last policy in the display has the highest index value.) |
| Instructions: | Use this parameter to assign precedence to policies that match the same route. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.7 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.7 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.7 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.7 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.7 |

| | |
|---|---|
| **Parameter:** | **Route Source** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | Any |
| Options: | Any \| Direct \| Static \| RIP \| OSPF (not valid for OSPF) \| EGP \| BGP |
| Function: | Specifies one or more route source identifiers. If you select a route source ID, a route from that source that meets the other criteria of this policy matches the policy. |
| Instructions: | To specify any source, use the default. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.8 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.8 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.8 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.8 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.8 |

**Parameter: Advertise**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | An empty list |
| Options: | A list of network identifiers |
| Function: | Specifies network IDs to include in place of the network IDs listed in the route to be advertised. |
| Instructions: | Specify a non-null value only if the announce Action parameter is Propagate. The values you enter in the advertise list determine the action taken.<br><br>If you supply a list of network IDs, these IDs are advertised instead of the actual IDs in the route.<br><br>If you use the default (an empty list), the actual IDs are advertised. Note that by default, BGP-4 aggregates subnets into their natural network IDs.<br><br>If you supply a list that includes the encoding 255.255.255.255/ 255.255.255.255, the actual network IDs are advertised along with the other IDs in the advertise list. This allows advertisement of an aggregate or default along with the actual network. If the actual network is a subnet (and the advertising protocol supports subnet advertisements), the subnet is advertised. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.10 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.10 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.10 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.10 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.10 |

| | |
|---|---|
| **Parameter:** | **From RIP Gateway** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | An empty list |
| Options: | A list of IP addresses |
| Function: | Specifies the addresses of one or more routers that could send RIP updates to this router. This policy applies to RIP advertisements from routers on this list, and applies only to RIP-sourced routes and if RIP is included as a route source. |
| Instructions: | Specify one or more IP addresses. Use the default empty list to indicate that this policy applies to RIP updates from any router. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.11 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.11 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.11 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.11 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.11 |

**Parameter: Received on RIP Interface**

Path: Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: An empty list

Options: A list of IP addresses

Function: Specifies the addresses of one or more interfaces on this router. This policy applies to RIP advertisements received on the interfaces in this list, and applies only to RIP-sourced routes and if RIP is included as a route source.

Instructions: Specify one or more IP addresses. Use the default empty list to indicate that this policy applies to RIP updates received on any interface.

MIB Object ID: RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.12

MIB Object ID: OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.12

MIB Object ID: EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.12

MIB Object ID: BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.12

MIB Object ID: BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.12

| | |
|---|---|
| **Parameter:** | **From OSPF Router ID** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | An empty list |
| Options: | A list of IP addresses |
| Function: | Specifies the IDs of one or more OSPF routers. This policy applies to OSPF advertisements authored by a router on this list, and applies only to OSPF-sourced routes and if OSPF is included as a route source. |
| Instructions: | Specify one or more IP addresses. Use the default empty list to indicate that this policy applies to OSPF updates from any router. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.13 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.13 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.13 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.13 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.13 |

**Parameter: Received OSPF Type**

Path: Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: Any

Options: Type 1 │ Type 2 │ External │ Internal │ Any

Function: Specifies which types of OSPF routes match this policy, and applies only to OSPF-sourced routes and if OSPF is included as a route source.

Instructions: To match any route type, enter Any. To match any non-ASE route, enter Internal. To match any ASE route, enter External. To match any external type 1 route, enter Type 1. To match any external type 2 route, enter Type 2.

MIB Object ID: RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.14

MIB Object ID: OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.14

MIB Object ID: EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.14

MIB Object ID: BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.14

MIB Object ID: BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.14

| | |
|---|---|
| **Parameter:** | **Received OSPF Tag** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | An empty list |
| Options: | A list of tag values |
| Function: | Specifies tag values that could be present in an OSPF ASE advertisement. This policy applies to OSPF ASE advertisements that contain tag values in this list, and applies only to OSPF-sourced ASE routes and if OSPF is included as a route source. |
| Instructions: | Specify one or more tag values. Use the default empty list to indicate that this policy applies to OSPF ASEs with any tag value. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.15 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.15 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.15 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.15 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.15 |

**Parameter: From EGP Peer**

Path: Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: An empty list

Options: A list of IP addresses

Function: Specifies the IP address of one or more EGP peers. This policy applies to EGP advertisements authored by a router on this list, and applies only to EGP source routes and if EGP is included as a route source.

Instructions: Specify one or more IP addresses. Use the default empty list to indicate that this policy applies to EGP advertisements from any router.

MIB Object ID: RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.16

MIB Object ID: OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.16

MIB Object ID: EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.16

MIB Object ID: BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.16

MIB Object ID: BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.16

| | |
|---|---|
| **Parameter:** | **From EGP AS** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | An empty list |
| Options: | A list of autonomous system numbers |
| Function: | Specifies one or more autonomous system numbers. This policy applies to EGP advertisements received from EGP peers in an AS on this list and applies only to EGP-sourced routes and if EGP is included as a route source. |
| Instructions: | Specify one or more AS numbers. Use the default empty list to indicate that this policy applies to EGP advertisements from peers in any AS. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.17 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.17 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.17 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.17 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.17 |

| | |
|---|---|
| **Parameter:** | **Received EGP Gateway** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | An empty list |
| Options: | A list of IP addresses |
| Function: | Specifies the IP address of one or more EGP gateways. This policy applies to EGP advertisements that use a gateway on this list as the next hop, and applies only to EGP-sourced routes and if EGP is included as a route source. |
| Instructions: | Specify one or more IP addresses. Use the default empty list to indicate that this policy applies to EGP advertisements with any gateway address. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.18 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.18 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.18 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.18 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.18 |

| | |
|---|---|
| **Parameter:** | **From BGP Peer** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | An empty list |
| Options: | A list of IP addresses |
| Function: | Specifies the IP address of one or more BGP peers. This policy applies to BGP advertisements authored by a router on this list, and applies only to BGP-sourced routes and if BGP is included as a route source. |
| Instructions: | Specify one or more IP addresses. Use the default empty list to indicate that this policy applies to BGP advertisements from any router. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.19 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.19 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.19 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.19 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.19 |

**Parameter: From BGP AS**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | An empty list |
| Options: | A list of autonomous system numbers |
| Function: | Specifies one or more autonomous system numbers. This policy applies to BGP advertisements received from BGP peers in an AS on this list, and applies only to BGP-sourced routes and if BGP is included as a route source. |
| Instructions: | Specify one or more AS numbers. Use the default empty list to indicate that this policy applies to BGP advertisements from peers in any AS. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.20 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.20 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.20 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.20 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.20 |

| | |
|---|---|
| **Parameter:** | **Received BGP Next Hop** |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | An empty list |
| Options: | A list of IP addresses |
| Function: | Specifies one or more IP addresses. This policy applies to BGP advertisements whose Next Hop attribute matches an IP address on this list and applies only to BGP-sourced routes and if BGP is included as a route source. |
| Instructions: | Specify one or more IP addresses. Use the default empty list to indicate that this policy applies to BGP advertisements with any Next Hop attribute. |
| MIB Object ID: | RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.21 |
| MIB Object ID: | OSPF: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.21 |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.21 |
| MIB Object ID: | BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.21 |
| MIB Object ID: | BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.21 |

# RIP-Specific Announce Policy Parameters

**Parameter: External Route Source**

Path: Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies

Default: Any

Options: Direct | Static | RIP | OSPF (with Type 2 metric) | EGP | BGP | Any

Function: Specifies one or more external route source identifiers. If you specify an external route source, a route from that source that meets the other criteria of this policy matches the policy.

Instructions: This parameter applies only to OSPF routes that use the new ASE Type 2 metric. The protocol from which OSPF received the route is encoded in the ASE metric, along with the route's metric. To specify any external route source, use the default.

MIB Object ID: RIP: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.9

**Parameter: Outbound Interfaces**

Path: Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies

Default: An empty list

Options: A list of IP addresses

Function: Specifies a list of outbound RIP interfaces. If an interface appears in this list, the policy applies to RIP advertisements sent via that interface.

Instructions: Specify one or more IP addresses. Configure an empty list to indicate that this policy applies to any outbound RIP interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.22

**Parameter:** **RIP Metric**

Path: Configuration Manager > Protocols > IP > Policy Filters > RIP > Announce Policies

Default: 0

Options: 0 or an export metric

Function: Specifies an optional export RIP metric to use when advertising a route that matches this policy.

Instructions: Set the Action parameter to Announce. If you use the default, the RIP metric is the routing table metric calculated for RIP plus the interface cost.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.2.1.23

## OSPF-Specific Announce Policy Parameters

**Parameter:** **Type**

Path: Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies

Default: 0

Options: Type 1 | Type 2 | 0

Function: Specifies an OSPF ASE metric type to use in advertisements for routes that match this policy.

Instructions: Enter 0 if you want to use the default metric that IP includes in the advertisement, based on the route source. For a BGP, EGP, or RIP route, the default is Type 2. For routes from all other sources, the default is Type 1. Set the Action parameter to propagate.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.22.

**Parameter: Tag**

Path: Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies

Default: Null

Options: Null or a tag value

Function: Specifies a value for the OSPF external route tag field. If the outgoing route matches this policy, the router places this value in the field.

Instructions: Set the Action parameter to Propagate and set the Automatic Tag parameter to Disable.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.23

**Parameter: Automatic Tag**

Path: Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies

Default: Disable

Options: Enable │ Disable

Function: Enables BGP/OSPF automatic tag generation.

Instructions: Select Disable (the default) to use the value you specify with the Tag parameter. Select Enable to generate a tag according to the criteria in RFC 1403 (or any superseding RFC). This parameter overrides the Tag Generation Method parameter on the OSPF Global Parameters window.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.24

**Parameter: OSPF Metric**

Path: Configuration Manager > Protocols > IP > Policy Filters > OSPF > Announce Policies

Default: 0

Options: 0 or an export metric

Function: Specifies an optional OSPF metric to use when advertising a route that matches this policy.

Instructions: Set the Action parameter for Announce. If you use the default, the OSPF metric is the routing table metric.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.4.1.25

# EGP-Specific Announce Policy Parameters

**Parameter: External Route Source**

Path: Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies

Default: Any

Options: Direct │ Static │ RIP │ OSPF (with Type 2 metric) │ EGP │ BGP │ Any

Function: Specifies one or more external route source identifiers. If you specify an external route source, a route from that source that meets the other criteria of this policy matches the policy.

Instructions: This parameter applies only to OSPF routes that use the new ASE Type 2 metric. The protocol from which OSPF received the route is encoded in the ASE metric, along with the route's metric. To specify any external route source, use the default.

MIB Object ID: EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.9

**Parameter: EGP Peer List**

Path: Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies

Default: An empty list

Options: A list of IP addresses

Function: Specifies a list of IP addresses of EGP peers. If a peer appears in this list, the policy applies to EGP advertisements sent to that peer.

Instructions: Specify one or more IP addresses. Use the default empty list to indicate that the policy applies to any BGP peer.

MIB Object ID: EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.22

**Parameter: EGP Interface List**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Default: | An empty list |
| Options: | A list of IP addresses |
| Function: | Specifies a list of outgoing interfaces. If an interface appears on this list, the policy applies to EGP advertisements sent via that interface. |
| Instructions: | Specify one or more IP addresses. Use the default empty list to indicate that this policy applies to any outbound interface. |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.23 |

**Parameter: EGP Metric**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > EGP > Announce Policies |
| Default: | 0 |
| Options: | 0 or an export metric value |
| Function: | Specifies an optional export metric to use when advertising a route that matches this policy. |
| Instructions: | Select the default to indicate that the routing table metric calculated for EGP is to be used. This parameter is valid only if the Action parameter is set to Propagate. |
| MIB Object ID: | EGP: 1.3.6.1.4.1.18.3.5.3.2.6.6.1.24 |

# BGP-3-Specific Announce Policy Parameters

**Parameter: External Route Source**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Default: Any

Options: Direct │ Static │ RIP │ OSPF (with Type 2 metric) │ EGP │ BGP │ Any

Function: Specifies one or more external route source identifiers. If you specify an external route source, a route from that source that meets the other criteria of this policy matches the policy.

Instructions: This parameter applies only to OSPF external routes that use the new ASE Type 2 metric. The protocol from which OSPF received the route is encoded in the ASE metric, along with the route's metric. To specify any external route source, use the default.

MIB Object ID: BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.9

**Parameter: Outbound Peer AS List**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Default: An empty list

Options: A list of AS numbers

Function: Specifies a list of autonomous system numbers. If an AS number is included in this list, this policy applies to BGP advertisements being sent to BGP peers in that AS.

Instructions: Specify one or more AS numbers. Use the default empty list to indicate that this policy applies to BGP advertisements going to peers in any AS.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.22

**Parameter: Outbound Peers**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Default: An empty list

Options: A list of IP numbers

Function: Specifies the IP address of one or more BGP peers. If a BGP peer is included in this list, this policy applies to BGP advertisements being sent to that peer.

Instructions: Specify one or more IP addresses. Configure an empty list to indicate that this policy applies to BGP advertisements being sent to any peer.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.23

**Parameter: Inter-AS Metric Selector**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Default: None

Options: None │ Specified │ Originating

Function: Indicates whether or not an inter-AS metric is to be advertised for a network matching this policy and, if advertised, what value to use.

Instructions: Select None to indicate that no metric is to be advertised. Select Specified to indicate that the value you specify in the Specific Inter-AS Metric parameter is to be used. Select Originating to indicate that the metric from the originating protocol will be used. This parameter is valid only if the Action parameter is set to Propagate.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.24

**Parameter: Specific Inter-AS Metric**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Default: Null

Options: Null or an AS metric

Function: Specifies a value for the inter-AS metric.

Instructions: Supply a value and set the inter-AS Metric Selector parameter to Specified.

MIB Object ID: BGP-3: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.25

**Parameter: Origin**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Default: As Is

Options: As Is │ IGP │ EGP │ Incomplete

Function: Specifies an Origin attribute override. The Origin attribute of a route matching this policy will be replaced with the indicated value.

Instructions: To allow the existing Origin attribute, use the default.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.26

**Parameter: AS Path Override**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies

Default: An empty list

Options: A list of AS numbers

Function: Specifies an AS path override.

Instructions: Enter a non-null value to override the AS path attribute of a route matching this policy. Each element of the AS path is an AS number. Valid only if the Action parameter is set to Propagate. Use the default empty list to allow the existing AS path attribute to remain in the route.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.8.1.27

**Parameter: Next Hop**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Default: | Null |
| Options: | An IP address |
| Function: | Overrides the Next Hop path attribute with the IP address you specify. |
| Instructions: | To allow the existing Next Hop attribute, use the default null value. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.6.8.1.28 |

**Parameter: Community Match**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-3 > Announce Policies |
| Default: | An empty list |
| Options: | A list of BGP communities |
| Function: | Specifies one or more BGP communities. This policy applies to all BGP advertisements that match the list. |
| Instructions: | Supply an octet string using the following format: each community ID is 4 bytes long; 0 in the two most significant bits causes the router to perform the match on the lower 16 bits; the default empty list means “match any list.” |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.6.8.1.31 |

# BGP-4-Specific Announce Policy Parameters

**Parameter: External Route Source**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: Any

Options: Direct │ Static │ RIP │ OSPF (with Type 2 metric) │ EGP │ BGP │ Any

Function: Specifies one or more external route source identifiers. If you specify an external route source, a route from that source that meets the other criteria of this policy matches the policy.

Instructions: This parameter applies only to OSPF routes that use the new ASE type 2 metric. The protocol from which OSPF received the route is encoded in the ASE metric, along with the route's metric. To specify any external route source, use the default.

MIB Object ID: BGP-4: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.9

**Parameter: Outbound Peer AS**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: An empty list

Options: A list of AS numbers

Function: Specifies a list of autonomous system numbers. If an AS number is included in this list, this policy applies to BGP advertisements being sent to BGP peers in that AS.

Instructions: Specify one or more AS numbers. Configure an empty list to indicate that this policy applies to BGP advertisements going to peers in any AS.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.22

**Parameter: Outbound Peers**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: An empty list

Options: A list of IP addresses

Function: Specifies the IP address of one or more BGP peers. If a BGP peer is included in this list, this policy applies to BGP advertisements being sent to that peer.

Instructions: Specify one or more IP addresses. Configure an empty list to indicate that this policy applies to BGP advertisements being sent to any peer.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.23

**Parameter: Multi-Exit Discriminator**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: None

Options: None │ Specified │ Originating

Function: Indicates whether or not a Multi-Exit Discriminator metric is to be advertised for a network matching this policy and, if advertised, what value to use.

Instructions: Select None to indicate that no value is to be advertised. Select Specified to indicate that the value you specify for the Multi-Exit Discriminator Value parameter is to be used. Select Originating to indicate that the metric from the originating protocol is to be used. This parameter is valid only if the Action parameter is set to Propagate.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.24

**Parameter: Multi-Exit Discriminator Value**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: Null

Options: Null or a metric value

Function: Specifies a metric for the Multi-Exit Discriminator attribute.

Instructions: To advertise a multi-exit discriminator value, set the Action parameter to Propagate and set the Multi-Exit Discriminator parameter to Specified.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.25

**Parameter: Origin**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: As Is

Options: As Is │ IGP │ EGP │ Incomplete

Function: Specifies an Origin attribute override. The Origin attribute of a route matching this policy will be replaced with the indicated value.

Instructions: To allow the existing Origin attribute, use the default.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.26

**Parameter: AS Path**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: Null

Options: An AS path

Function: Specifies an AS path that overrides the AS-path attribute of a route matching this policy.

Instructions: Constructs a BGP-4 AS path composed of AS path segments. Each AS path segment includes a path segment type, a path segment length specifying the number of ASs in the segment, and a path segment value containing one or more AS numbers. There are two AS path segment types: type 1, an unordered set of ASs that a route in the UPDATE message has traversed, and type 2, an ordered set of ASs that a route in the UPDATE message has traversed.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.27

**Parameter: Local Preference Override**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: Local Pref Override False

Options: False | True

Function: Indicates whether or not you are supplying an override value for the Local Preference path attribute in the routing Update message. (The Local Pref attribute is valid only in an Update advertised to an IBGP peer.) If you select False, the router uses the IP route weight value to calculate the LOCAL_PREF path attribute.

Instructions: To override the Local Preference attribute, select True and supply a value for the Local Preference Value parameter.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.28

**Parameter: Local Preference Value**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: Null

Options: Null or a route weight value

Function: Specifies an override value for the Local Preference attribute.

Instructions: Enter a value and set the Local Preference Override parameter to True.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.29

**Parameter: Next Hop**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: Null

Options: An IP address

Function: Overrides the Next Hop path attribute with the IP address you specify.

Instructions: To allow the existing Next Hop attribute, use the default null value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.6.10.1.30

**Parameter: Atomic**

Path: Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies

Default: Automatic

Options: Automatic │ Force │ Ignore

Function: Allows control over the atomic path attribute.

Instructions: By default, the router automatically sets this parameter if it knows that certain networks in aggregate range have not been included in an aggregate advertisement.

MIB Object ID: To include the atomic attribute even if the router does not assume one is required, set the parameter to Force.

**Parameter: AS Pattern**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | Empty string |
| Options: | Any regular expression or empty string |
| Function: | Allows AS_PATH pattern matching. |
| Instructions: | Enter a valid regular expression to indicate an AS and its position in a path. The policy applies to all routes whose AS path includes the AS in that position. For example, the expression * 200 $ means that the policy applies to all routes whose AS_PATH attribute contains AS 200 as the last AS in the path. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.6.10.1.32 |

**Parameter: Community Match**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Policy Filters > BGP-4 > Announce Policies |
| Default: | An empty list |
| Options: | A list of BGP communities |
| Function: | Specifies one or more BGP communities. This policy applies to all BGP advertisements that match the list. |
| Instructions: | Supply an octet string using the following format: each community ID is 4 bytes long; 0 in the two most significant bits causes the router to perform the match on the lower 16 bits; the default empty list means “match any list.” |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.6.10.1.35 |

# Appendix C
# Import and Export Route Filters

## RIP Import Filters

| | |
|---|---|
| **Parameter:** | **Import Address** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > RIP > Import Filters |
| Default: | 0.0.0.0 |
| Options: | Any IP network address |
| Function: | Identifies, by IP address, the network to which this filter applies. If this field is set to 0.0.0.0, the filter applies to all networks. |
| Instructions: | Enter the appropriate network address in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.8.1.3 |

**Parameter: Import Mask**

Path: Configuration Manager > Protocols > IP > Route Filters > RIP > Import Filters

Default: 0.0.0.0

Options: Depends on the address class of the network address

Function: Specifies the range of addresses this filter acts upon.

Instructions: For example, consider Class B Network 172.32.0.0, which allocates the upper 8 bits of the host identification field to the Subnet ID, and the final 8 bits to the Host ID. The address mask directs the filtering process to a specific portion of the IP address. In other words, any IP address that matches the masked portion of 172.32.0.0 is subject to filtering. If you enter 255.255.0.0 for this parameter, only the Net ID portion of the address will be filtered. If you enter the mask 255.255.255.0 for this parameter, the Net ID and Subnet ID portions of the address will be filtered. If the Import Address field is set to 0.0.0.0, and this parameter is set to 0.0.0.0, then the filter applies to *all* routes. If the Import Address field is set to 0.0.0.0, and this parameter is set to 255.255.255.255, then the filter applies to the *default* route. Enter the mask in dotted-decimal notation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.8.1.4

**Parameter: RIP Gateway**

Path: Configuration Manager > Protocols > IP > Route Filters > RIP > Import Filters

Default: 0.0.0.0

Options: Any IP address

Function: Identifies, by IP address, the router that is sending the updates. This filter will apply to updates from that router. If this field is set to 0.0.0.0, the filter applies to updates from any router.

Instructions: Enter the appropriate IP address in dotted-decimal notation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.8.1.7

| | |
|---|---|
| **Parameter:** | **Interface** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > RIP > Import Filters |
| Default: | 0.0.0.0 |
| Options: | Any IP address |
| Function: | Specifies the local IP address of the interface that connects this router to the RIP gateway. This filter will apply only to those updates received on this interface. If set to 0.0.0.0, this filter applies to all interfaces. |
| Instructions: | Enter the appropriate IP address in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.8.1.8 |

| | |
|---|---|
| **Parameter:** | **Action** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > RIP > Import Filters |
| Default: | Accept |
| Options: | Accept \| Ignore |
| Function: | Specifies whether the route is transferred to the routing tables. If this parameter is set to Accept (default), the routing information is sent to the routing tables. If this parameter is set to Ignore, the routing information is dropped. |
| Instructions: | Either accept the default Accept, or select Ignore. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.8.1.5 |

**Parameter: Preference**

Path: Configuration Manager > Protocols > IP > Route Filters > RIP > Import Filters

Default: 1

Options: 1 to 16

Function: Assigns a weighted preference value to a route included in the routing tables. If confronted with multiple routes to the same destination, the router, by default, grants preference to routes in the following order: direct, OSPF internal, static, BGP-3, OSPF external, EGP, and RIP.

Instructions: If this hierarchy is acceptable, accept the default value 1 for preference. If you want to grant preference to this RIP-derived route, assign a new preference value in the range of 1 to 16 (the greater the number, the higher the preference). Routes for all networks (0.0.0.0/0.0.0.0) should have the lowest preference. Routes for the most specific networks (longest address and mask) should have the highest preference. The default preference for static routes is 1, but may be set to any value from 1 to 16. If you want to grant a RIP-derived route preference over a static route, make sure the preference value you assign to the RIP-derived route is greater than the preference value of the static route you want it to override.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.8.1.6

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > Route Filters > RIP > Import Filters

Default: Enable

Options: Enable | Disable

Function: Enables or disables this import route filter.

Instructions: Set to Disable if you want to disable this filter. Set to Enable if you previously disabled this filter and now want to reenable it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.8.1.2

| | |
|---|---|
| **Parameter:** | **Apply Subnet Mask** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > RIP > Import Filters |
| Default: | Null or IP address mask |
| Options: | Specifies a mask that will override the interface's subnet mask in the presence of networks with variable-length subnet masks |
| Function: | Supply a mask, set the Action parameter to Accept, and use the default Network parameter (an empty list). |
| Instructions: | If you specify a mask of 0.0.0.0, the router determines which mask to apply. For example, if the network in the update is a subnet of the same network as the receiving interface, the router applies the mask of the receiving interface. If the network in the update is a subnet of a different natural network, the router applies the natural mask of that network. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.8.1.9 |

## RIP Export Filters

| | |
|---|---|
| **Parameter:** | **Export Address** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > RIP > Export Filters |
| Default: | 0.0.0.0 |
| Options: | Any IP network address |
| Function: | Identifies, by IP address, the network to which this filter applies. If set to 0.0.0.0, the filter applies to all networks. |
| Instructions: | Enter the appropriate IP address in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.9.1.3 |

**Parameter: Export Mask**

Path: Configuration Manager > Protocols > IP > Route Filters > RIP > Export Filters

Default: 0.0.0.0

Options: Depends on the address class of the network address

Function: Specifies the range of addresses upon which this filter acts

Instructions: For example, consider Class B Network 172.32.0.0, which allocates the upper 8 bits of the host identification field to the subnet ID, and the final 8 bits to the host ID. The address mask directs the filtering process to a specific portion of the IP address. In other words, any IP address that matches the masked portion of 172.32.0.0 is subject to filtering. If you enter 255.255.0.0 for this parameter, only the Net ID portion of the address will be filtered. If you enter the mask 255.255.255.0 for this parameter, the net ID and subnet ID portions of the address will be filtered. If you set the Export Address field to 0.0.0.0 and set this parameter to 0.0.0.0, then the filter applies to *all* routes. If you set the Export Address field to 0.0.0.0 and set this parameter to 255.255.255.255, then the filter applies to the *default* route. Enter the appropriate mask in dotted-decimal notation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.9.1.4

**Parameter: From Protocol**

Path: Configuration Manager > Protocols > IP > Route Filters > RIP > Export Filters

Default: Any

Options: Any | RIP | EGP | OSPF | Direct | Static | BGP-3

Function: Identifies the source of the routing information: direct connection, static route, or RIP-, OSPF-, EGP-, or BGP-3-derived route.

Instructions: Select the appropriate option.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.9.1.5

**Parameter: Interface**

Path: Configuration Manager > Protocols > IP > Route Filters > RIP > Export Filters
Default: 0.0.0.0
Options: Any IP address
Function: Identifies the outgoing IP interface for the RIP update. This filter will apply only to this interface. If set to 0.0.0.0, this filter applies to all interfaces.
Instructions: Enter the appropriate IP address in dotted-decimal notation.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.9.1.7

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > Route Filters > RIP > Export Filters
Default: Enable
Options: Enable | Disable
Function: Enables or disables this export route filter.
Instructions: Set to Disable if you want to disable this export route filter. Set to Enable if you previously disabled this export route filter and now want to reenable it.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.9.1.2

**Parameter: Action**

Path: Configuration Manager > Protocols > IP > Route Filters > RIP > Export Filters
Default: Propagate
Options: Propagate | Ignore | Aggregate
Function: Controls the flow of routing information. If you set this parameter to Propagate, this route is advertised. If you set this parameter to Ignore, advertising of this route is suppressed. If you set this parameter to Aggregate, the network is not explicitly advertised. Instead, the default route (0.0.0.0) is advertised.
Instructions: Either accept the default, Propagate, or select Ignore or Aggregate.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.9.1.6

| | |
|---|---|
| **Parameter:** | **RIP Metric** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > RIP > Export Filters |
| Default: | 0 (the actual route cost as learned) |
| Options: | 0 to 15 |
| Function: | Assigns a RIP cost to the propagated route. The value 0 causes the actual route cost (as learned) to be used. |
| Instructions: | Accept the default value 0 or enter a new value. Do not use a value that exceeds the diameter of the RIP network. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.9.1.8 |

## OSPF Import Filters

| | |
|---|---|
| **Parameter:** | **Import Address** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > OSPF > Import Filters |
| Default: | None |
| Options: | An IP address |
| Function: | Identifies, by IP address, the network to which this filter applies. If set to 0.0.0.0, the filter applies to all networks. |
| Instructions: | Enter the appropriate network address in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.10.1.3 |

| | |
|---|---|
| **Parameter:** | **Preference** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > OSPF > Import Filters |
| Default: | 0 |
| Options: | 0 to 16 |
| Function: | Assigns a weighted preference value to a route included in the routing tables. If confronted with multiple routes to the same destination, the router, by default, grants preference to routes in the following order: direct, OSPF internal, static, BGP-3, OSPF external, EGP, and RIP. |
| Instructions: | If this hierarchy is acceptable, accept the default value 0 for preference. If you want to grant preference to this OSPF-derived route, assign a new preference value in the range of 1 to 16 (the greater the number, the higher the preference). Routes for all networks (0.0.0.0/0.0.0.0) should have the lowest preference. Routes for the most specific networks (longest address and mask) should have the highest preference. The default preference for static routes is 0, but it may be set to any value from 0 to 16. If you want to grant an OSPF-derived route preference over a static route, make sure the preference value you assign to the OSPF-derived route is greater than the preference value of the static route you want it to override. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.10.1.6 |

## OSPF Export Filters

| | |
|---|---|
| **Parameter:** | **Export Address** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > OSPF > Export Filters |
| Default: | 0.0.0.0 |
| Options: | Any IP network address |
| Function: | Identifies, by IP address, the network to which this filter applies. If set to 0.0.0.0, the filter applies to all networks. |
| Instructions: | Enter the appropriate IP address in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.11.1.3 |

**Parameter: Export Mask**

Path: Configuration Manager > Protocols > IP > Route Filters > OSPF > Export Filters

Default: None

Options: Depends on the address class of the network address

Function: Specifies the range of addresses upon which this filter acts.

Instructions: For example, consider Class B Network 172.32.0.0. The address mask directs the filtering process to a specific portion of the IP address. In other words, any IP address that matches the masked portion of 172.32.0.0 is subject to filtering. If you enter 255.255.0.0 for this parameter, only the Net ID portion of the address will be filtered. If you enter the mask 255.255.255.0 for this parameter, the Net ID and Subnet ID portions of the address will be filtered. If you set the Export Address field to 0.0.0.0 and set this parameter to 0.0.0.0, then the filter applies to *all* routes. If you set the Export Address field to 0.0.0.0 and set this parameter to 255.255.255.255, then the filter applies to the *default* route. Enter the appropriate mask in dotted-decimal notation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.11.1.4

**Parameter: Export From Protocol**

Path: Configuration Manager > Protocols > IP > Route Filters > OSPF > Export Filters

Default: RIP

Options: Any | RIP | EGP | OSPF | Direct | static | BGP-3

Function: Identifies the source of the routing information: direct connection, static route, or RIP, EGP, OSPF, or BGP-3-derived route.

Instructions: Select the appropriate option.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.11.1.5

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > Route Filters > OSPF > Export Filters
Default: Enable
Options: Enable | Disable
Function: Enables or disables this export route filter.
Instructions: Set to Disable if you want to disable this export route filter. Set to Enable if you previously disabled this export route filter and now want to reenable it.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.11.1.2

**Parameter: Action**

Path: Configuration Manager > Protocols > IP > Route Filters > OSPF > Export Filters
Default: Propagate
Options: Propagate | Ignore
Function: Controls the flow of routing information. If you set this parameter to Propagate, this route is advertised. If you set this parameter to Ignore, advertising of this route is suppressed.
Instructions: Either accept the default, Propagate, or select Ignore.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.11.1.6

**Parameter: Type**

Path: Configuration Manager > Protocols > IP > Route Filters > OSPF > Export Filters
Default: Type 1
Options: As Is | Type 1 | Type 2
Function: Specifies an OSPF ASE metric type to use in advertisements for routes that match this policy.
Instructions: Select As Is if you want to use the default metric that IP includes in the advertisement, based on the route source. For a BGP, EGP, or RIP route, the default is Type 2. For routes from all other sources, the default is Type 1. Set the Action parameter to Propagate.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.11.1.7

| | |
|---|---|
| **Parameter:** | **Tag** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > OSPF > Export Filters |
| Default: | 1 |
| Options: | 1 to 2,147,483,647 |
| Function: | Sets the tag value for the AS external advertisement that is generated for this network. This parameter has meaning only when the Action parameter is set to Propagate. |
| Instructions: | Enter the appropriate tag. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.11.1.8 |

| | |
|---|---|
| **Parameter:** | **Auto Tag** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > OSPF > Export Filters |
| Default: | Disable |
| Options: | Enable \| Disable |
| Function: | If enabled, the router creates a tag for this route as described in RFC 1364 (BGP/OSPF Interaction). |
| Instructions: | Set to Enable if you are running BGP-3 as your exterior gateway protocol. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.11.1.9 |

## BGP-3 Import Filters

| | |
|---|---|
| **Parameter:** | **Import Address** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > BGP3 > Import Filters |
| Default: | 0.0.0.0 |
| Options: | Any IP network address |
| Function: | Identifies, by IP address, the network to which this filter applies. |
| Instructions: | Enter the appropriate network address in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.14.1.3 |

**Parameter:** **Import Mask**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Import Filters

Default: 0.0.0.0

Options: Depends on the address class of the network address

Function: Specifies the range of addresses upon which this filter acts.

Instructions: For example, consider Class B Network 172.32.0.0, which allocates the upper 8 bits of the host identification field to the Subnet ID, and the final 8 bits to the Host ID. The address mask directs the filtering process to a specific portion of the IP address. In other words, any IP address that matches the masked portion of 172.32.0.0 is subject to filtering. If you enter 255.255.0.0 for this parameter, only the Net ID portion of the address will be filtered. If you enter the mask 255.255.255.0, the net ID and subnet ID portions of the address will be filtered. If you set the Import Address field to 0.0.0.0 and set this parameter to 0.0.0.0, then the filter applies to *all* routes. If you set the Import Address field to 0.0.0.0 and set this parameter to 255.255.255.255, then the filter applies to the *default* route. Enter the appropriate mask in dotted-decimal notation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.14.1.4

**Parameter:** **Import Peer AS**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Import Filters

Default: 0

Options: 0 to 65,535

Function: Identifies the autonomous system to which the BGP router at the remote end of this BGP peer connection belongs. This filter will apply to updates from this router. The value 0 means any AS.

Instructions: Enter the appropriate AS number.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.14.1.7

**Parameter: Import Peer Address**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Import Filters

Default: 0.0.0.0

Options: Any IP address

Function: Specifies the IP address of the interface on the remote side of this BGP peer connection. This filter will apply to updates from this router. The value 0 means any peer.

Instructions: Enter the IP address in dotted-decimal notation. If the peer is in a remote AS, the address must be on the same subnet as the local interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.14.1.8

**Parameter: Import Originating AS**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Import Filters

Default: 0

Options: 0 to 65,535

Function: Specifies the AS from which the route originated (the last AS in the AS path). The filter will apply to updates created by any routers in this AS. The value 0 means any AS.

Instructions: Enter the appropriate AS number.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.14.1.9

**Parameter: Import Route Origin**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Import Filters

Default: Any

Options: Any | IGP | EGP | Incomplete

Function: Specifies the value of the Origin Path attribute in the update message received.

Instructions: Set the appropriate Import Route Origin value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.14.1.10

**Parameter: Import Action**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Import Filters

Default: Ignore

Options: Accept | Ignore

Function: Specifies whether the route is transferred to the routing tables. If you set this parameter to Accept, the routing information is sent to the routing tables. If you select Ignore, the routing information is dropped.

Instructions: Either accept the default, Ignore, or select Accept.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.14.1.5

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Import Filters

Default: Enable

Options: Enable | Disable

Function: Enables or disable this import route filter.

Instructions: Set to Disable if you want to disable this filter. Set to Enable if you previously disabled this filter and now want to reenable it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.14.1.2

**Parameter: Preference**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Import Filters

Default: 1

Options: 1 to 16

Function: Assigns a weighted preference value to a route included in the routing tables. If confronted with multiple routes to the same destination, the router, by default, grants preference to routes in the following order: direct, OSPF internal, BGP-3, static, OSPF, external, and RIP. If Intra-AS IBGP routing is used, then any other route source is preferred over a BGP-3 route.

Instructions: If this hierarchy is acceptable, accept the default value 1 for preference. If you want to grant preference to this BGP-3-derived route, assign a new preference value in the range of 1 to 16 (the greater the number, the higher the preference). The default preference for static routes is 16, but may be set to any value from 1 to 16. If you want to grant a BGP-3-derived route preference over a static route, make sure the preference you assign to the BGP-3-derived route exceeds the preference value of the static route you want it to override. Either accept the default value, 1, or enter a new value. Routes for all networks (0.0.0.0/0.0.0.0) should have the lowest preference. Routes for the most specific networks (longest address and mask) should have the highest preference.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.14.1.11

**Parameter: BGP-3 Preference**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Import Filters

Default: 1

Options: 1 to 2,147,483,647

Function: Assigns a weighted preference value to a route included in the routing tables. If confronted with multiple BGP-3 routes to the same destination, the router, by default, grants preference to routes assigned the highest preference value.

Instructions: Either accept the default value, 1, or enter a new value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.14.1.12

# BGP-3 Export Filters

**Parameter: Export Address**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Export Filters

Default: 0.0.0.0

Options: Any IP network address

Function: Identifies, by IP address, the network to which this filter applies. If this field is left blank, the filter applies to all networks.

Instructions: Enter the appropriate network address in dotted-decimal notation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.15.1.3

**Parameter: Export Mask**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Export Filters

Default: 0.0.0.0

Options: Depends on the address class of the network address

Function: Specifies the range of addresses upon which this filter acts.

Instructions: For example, consider Class B Network 172.32.0.0, which allocates the upper 8 bits of the host identification field to the Subnet ID, and the final 8 bits to the Host ID. The address mask directs the filtering process to a specific portion of the IP address. In other words, any IP address that matches the masked portion of 172.32.0.0 is subject to filtering. If you enter 255.255.0.0 for this parameter, only the Net ID portion of the address will be filtered. If you enter the mask 255.255.255.0 for this parameter, the Net ID and Subnet ID portions of the address will be filtered. If you set the Export Address field to 0.0.0.0 and set this parameter to 0.0.0.0, then the filter applies to *all* routes. If you set the Export Address field to 0.0.0.0 and set this parameter to 255.255.255.255, then the filter applies to the *default* route. Enter the appropriate mask in dotted-decimal notation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.15.1.4

| | |
|---|---|
| **Parameter:** | **Export from Protocol** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > BGP3 > Export Filters |
| Default: | Any |
| Options: | Any \| RIP \| EGP \| OSPF \| Direct \| Static \| BGP-3 |
| Function: | Identifies the source of the routing information: direct connection, static route, or a RIP-, EGP-, OSPF-, or BGP-3 derived route. |
| Instructions: | Select the appropriate option. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.15.1.5 |

| | |
|---|---|
| **Parameter:** | **Export Peer AS** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > BGP3 > Export Filters |
| Default: | 0 |
| Options: | 1 to 65,535 |
| Function: | Identifies the autonomous system to which the BGP router at the remote end of this BGP peer connection belongs. This filter will apply to updates sent to any router in this AS. The value 0 means any AS. |
| Instructions: | Enter the appropriate AS number. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.15.1.7 |

| | |
|---|---|
| **Parameter:** | **Export Peer Address** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > BGP3 > Export Filters |
| Default: | 0.0.0.0 |
| Options: | Any IP address |
| Function: | Specifies the IP address of the interface on the remote side of this BGP peer connection. This filter will apply to updates sent to this router. The value 0.0.0.0 means any peer. |
| Instructions: | Enter the IP address in dotted-decimal notation. If the peer is in a remote AS, the address must be on the same subnet as the local interface. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.15.1.8 |

**Parameter: Export Enable**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Export Filters
Default: Enable
Options: Enable | Disable
Function: Enables or disables this export route filter.
Instructions: Set to Disable if you want to disable this filter. Set to Enable if you want to enable this filter.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.15.1.2

**Parameter: Export Action**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Export Filters
Default: Ignore
Options: Propagate | Ignore | Aggregate
Function: Controls the flow of routing information. If set to Propagate, this route is advertised. If set to Ignore, advertising of this route is suppressed. If set to Aggregate, the network is not explicitly advertised. Instead, the default route (0.0.0.0) is advertised.
Instructions: Select Propagate, Ignore, or Aggregate.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.15.1.6

**Parameter: Export Use Inter AS Metric**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Export Filters
Default: None
Options: None | Specified | Originating
Function: Specifies whether or not an Inter AS metric is advertised for the associated networks. If set to None, then no metric is advertised. If set to Specified, then the value specified for the Export Inter AS Metric parameter is advertised. If set to Originating, then the metric from the originating protocol is advertised. This parameter is only valid if Export Action is set to propagate.
Instructions: Set to the appropriate option.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.15.1.11

**Parameter:** **Export Origin**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Export Filters

Default: Any

Options: Any | IGP | EGP | Incomplete

Function: If From Protocol is set to RIP or Static, and Action is set to Propagate, you can use this parameter to change the Origin attribute that is advertised for this network.

Instructions: If you want to change the Origin attribute, select a valid option.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.15.1.13

**Parameter:** **Export Neighbor AS**

Path: Configuration Manager > Protocols > IP > Route Filters > BGP3 > Export Filters

Default: 0

Options: 0 to 65,535

Function: If the Export Action parameter is set to Propagate, and the Export Origin parameter is set to EGP, then this parameter must be set to a nonzero value. The value specified here is used as the EGP neighbor AS number when the AS path is constructed.

Instructions: Specify a value within the assigned range.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.15.1.14

# EGP Import Filters

| | |
|---|---|
| **Parameter:** | **Import Address** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > EGP > Import Filters |
| Default: | 0.0.0.0 |
| Options: | Any IP network address |
| Function: | Identifies, by IP address, the network to which this filter applies. If this field is set to 0.0.0.0, the filter applies to all networks. |
| Instructions: | Enter the appropriate network address in dotted-decimal notation. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.12.1.3 |

| | |
|---|---|
| **Parameter:** | **Import Peer** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > EGP > Import Filters |
| Default: | 0.0.0.0 |
| Options: | Any IP address |
| Function: | Specifies the IP address of the interface on the remote side of this EGP peer connection. This filter will apply to updates from this router. The default 0.0.0.0 means any peer. |
| Instructions: | Enter the IP address in dotted-decimal notation. If the peer is in a remote AS, the address must be on the same subnet as the local interface. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.12.1.7 |

| | |
|---|---|
| **Parameter:** | **Import Autonomous System** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > EGP > Import Filters |
| Default: | 0 |
| Options: | 0 to 65,535 |
| Function: | Identifies the AS to which the EGP router at the remote end of this EGP peer connection belongs. This filter will apply to updates from this router. The default 0 means any AS. |
| Instructions: | Enter the appropriate AS number. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.12.1.8 |

**Parameter: Import Gateway**

Path: Configuration Manager > Protocols > IP > Route Filters > EGP > Import Filters
Default: 0.0.0.0
Options: Any IP address
Function: Specifies the gateway advertised as the next hop for the network. The default value of 0 means any gateway.
Instructions: Enter the appropriate gateway number.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.12.1.9

**Parameter: Enable**

Path: Configuration Manager > Protocols > IP > Route Filters > EGP > Import Filters
Default: Enable
Options: Enable | Disable
Function: Enables or disables this import route filter.
Instructions: Set to Disable if you want to disable this filter. Set to Enable if you previously disabled this filter and now want to reenable it.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.12.1.2

**Parameter: Action**

Path: Configuration Manager > Protocols > IP > Route Filters > EGP > Import Filters
Default: Accept
Options: Accept | Ignore
Function: Specifies whether the route is transferred to the routing tables. If you select Accept (default), the routing information is sent to the routing tables. If you select Ignore, the routing information is dropped.
Instructions: Either accept the default, Accept, or select Ignore.
MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.12.1.5

**Parameter: Preference**

Path: Configuration Manager > Protocols > IP > Route Filters > EGP > Import Filters

Default: 1

Options: 1 to 15

Function: Assigns a weighted precedence value to a route included in the routing tables. If confronted with multiple routes to the same destination, the router, by default, grants preference to routes in the following order: direct, OSPF internal, static, BGP-3, OSPF external, and RIP. If this hierarchy is acceptable, accept the default value 1 for preference. If you want to grant preference to this OSPF-derived route, assign a new preference value in the range of 1 to 15 (the greater the number, the higher the preference).

Instructions: Either accept the default value 1, or enter a new value. Routes for all networks (0.0.0.0/0.0.0.0) should have the lowest preference. Routes for the most specific networks (longest address and mask) should have the highest preference.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.12.1.6

## EGP Export Filters

**Parameter: Export Address**

Path: Configuration Manager > Protocols > IP > Route Filters > EGP > Export Filters

Default: 0.0.0.0

Options: Any IP network address

Function: Identifies, by IP address, the network to which this filter applies. If set to 0.0.0.0, the filter applies to all networks.

Instructions: Enter the appropriate IP address in dotted-decimal notation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.13.1.3

**Parameter: Export Mask**

Path: Configuration Manager > Protocols > IP > Route Filters > EGP > Export Filters

Default: 0.0.0.0

Options: Depends on the address class of the network address

Function: Specifies the range of addresses this filter acts upon. For example, consider Class B Network 172.32.0.0, which allocates the upper 8 bits of the host identification field to the Subnet ID and the final 8 bits to the Host ID. The address mask directs the filtering process to a specific portion of the IP address. Thus, any IP address that matches the masked portion of 172.32.0.0 is subject to filtering. If you enter 255.255.0.0 for this parameter, only the net ID portion of the address is filtered. If you enter the mask 255.255.255.0, the Net ID and Subnet ID portions of the address are filtered. If you set the Export Address field to 0.0.0.0 and set this parameter to 0.0.0.0, then the filter applies to *all* routes. If you set the Export Address field to 0.0.0.0 and set this parameter to 255.255.255.255, then the filter applies to the *default* route.

Instructions: Enter the mask in dotted-decimal notation.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.13.1.4

**Parameter: Export From Protocol**

Path: Configuration Manager > Protocols > IP > Route Filters > EGP > Export Filters

Default: Any

Options: Any | RIP | EGP | OSPF | Direct | Static | BGP-3

Function: Identifies the source of the routing information: direct connection, static route, or RIP-, EGP-, OSPF-, or BGP-3-derived route.

Instructions: Select the appropriate option.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.13.1.5

**Parameter: Export Peer**

Path: Configuration Manager > Protocols > IP > Route Filters > EGP > Export Filters

Default: 0.0.0.0

Options: Any IP address

Function: Specifies the IP address of the interface on the remote side of this EGP peer connection. This filter will apply to updates from this router. The default value 0.0.0.0 means any router.

Instructions: Enter the IP address in dotted-decimal notation. The address must be on the same subnet as a local interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.13.1.7

**Parameter: Export OSPF Type**

Path: Configuration Manager > Protocols > IP > Route Filters > EGP > Export Filters

Default: None

Options: Type 1 | Type 2 | Internal

Function: Specifies the type of routes to which this filter applies. If you specify Type 1, then only AS external type 1 routes are filtered. If you specify type 2, then only AS external type 2 routes are filtered. Note that this parameter is used only if the Export From Protocol parameter is set to OSPF.

Instructions: Depending on the type of routes you want to filter, select Type 1, Type 2, or Internal.

MIB Object ID: 1.3.6.1.4.1.18.3.5.3.2.1.13.1.8

| | |
|---|---|
| **Parameter:** | **Export OSPF Tag** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > EGP > Export Filters |
| Default: | 0 |
| Options: | 0 to 2,147,483,647 |
| Function: | Specifies the tag with which this route filter is concerned. Each AS External Advertisement contains a Tag field. If the Tag field matches Import Tag, the appropriate action is taken; either the route is accepted or ignored. Note that this parameter is used only if the Export From Protocol parameter is set to OSPF. |
| Instructions: | Enter the appropriate tag number. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.13.1.9 |

| | |
|---|---|
| **Parameter:** | **Enable** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > EGP > Export Filters |
| Default: | Enable |
| Options: | Enable \| Disable |
| Function: | Enables or disables this export route filter. |
| Instructions: | Set to Disable if you want to disable this export route filter. Set to Enable if you previously disabled this export route filter and now want to reenable it. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.13.1.2 |

| | |
|---|---|
| **Parameter:** | **Action** |
| Path: | Configuration Manager > Protocols > IP > Route Filters > EGP > Export Filters |
| Default: | Propagate |
| Options: | Propagate \| Ignore |
| Function: | Controls the flow of routing information. If you select Propagate, this route is advertised. If you select Ignore, advertising of this route is suppressed. |
| Instructions: | Either accept the default, Propagate, or select Ignore. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.13.1.6 |

**Parameter: Interface**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Route Filters > EGP > Export Filters |
| Default: | 0.0.0.0 |
| Options: | Any IP address |
| Function: | Specifies the outbound interface on which to apply this filter. |
| Instructions: | Specify the IP address of the interface on which you want to apply this filter. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.13.1.10 |

**Parameter: Metric**

| | |
|---|---|
| Path: | Configuration Manager > Protocols > IP > Route Filters > EGP > Export Filters |
| Default: | 0 (the actual route cost as learned) |
| Options: | 0 to 255 |
| Function: | Assigns an EGP cost to the propagated route. The value 0 causes the actual route cost (as learned) to be used. |
| Instructions: | Either accept the default metric value, 0, or enter a new value. |
| MIB Object ID: | 1.3.6.1.4.1.18.3.5.3.2.1.13.1.11 |

# Appendix D
# Route Weight Worksheet

1. **Select one route from the following list:**

| | |
|---|---|
| Direct | 0 |
| OSPF Internal | 0 |
| OSPF External | 16 (OSPF import preference) |
| RIP | 16 (RIP import preference) |
| EGP | 16 (EGP import preference) |
| BGP | 16 (BGP import preference) |
| Static | 16 (SR preference) |

2. **Multiply the value associated with the route by the following decimal or hexadecimal value:**

   134217728 x _____=_____

   or

   0x8000000 x ____ = _____

3. **Select one route from the following list:**

| | |
|---|---|
| Direct | 0 |
| OSPF intra-area Internal | 0 |
| OSPF inter-area Internal | 1 |
| OSPF type 1 external | 2 |
| OSPF type 2 external | 3 |
| Non-OSPF external (RIP, EGP, BGP) | 3 |
| Static | 3 |

4. **Multiply the value associated with the route by the following decimal or hexadecimal value:**

   16777216 x _____ = _____

   or

   0x1000000 x _____ = _____

5. **Select one route from the following list:**

| | |
|---|---|
| Direct | 0 |
| OSPF internal | 0 |
| OSPF type 2 external w/ASE metric support enabled | 0 |
| EBGP | 2 |
| RIP | 4 |
| EGP | 5 |
| Static | 6 |
| OSPF type 2 external w/ASE metric support disabled | 7 |

6. **Multiply the value associated with the route by the following decimal or hexadecimal value:**

   2097152 x _____ = _____

   or

   0x200000 x _____ = _____

7. **Select one route from the following list and calculate the associated value using the formulas supplied:**

| | |
|---|---|
| Direct | OSPF interface ? OSPF interface metric : 0 |
| OSPF imported | OSPF-TOS-0 Metric |
| BGP-3 imported | Calculate a decimal or hexadecimal value using one of the following formulas:<br><br>8192 * (16 - BGP3 Import BGP3 Preference) + (IGP Origin ? 0 : 4096) +<br>(AS Weighted Path Length <= 4095 ?<br>AS Weighted Path Length : 4095)<br><br>or<br><br>(0x2000 * (16 - BGP3 Import BGP3 Preference) +<br>(IGP Origin ? 0 : 0x1000) +<br>(AS Weighted Path Length <= 0x0fff ?<br>AS Weighted Path Length : 0x0fff) |
| BGP-4 imported | Calculate a decimal or hexadecimal value using one of the following formulas:<br><br>8192 * (16 - BGP4 Import BGP3 Preference)) +<br>(IGP Origin ? 0 : 4096) +<br>(AS Weighted Path Length <= 4095 ?<br>AS Weighted Path Length : 4095)<br><br>or<br><br>0x2000 * (16 - BGP4 Import BGP3 Preference) +<br>(IGP Origin ? 0 : 0x1000) +<br>(AS Weighted Path Length <= 0x0fff ?<br>AS Weighted Path Length : 0x0fff) |

| | |
|---|---|
| IBGP imported | Calculate a decimal or hexadecimal value using one of the following formulas:<br><br>8192 * (16 - BGP4 Import BGP3 Preference) + (Local Pref <= 8191 ? 8191 - Local Pref : 0)<br><br>or<br><br>0x2000 * (16 - BGP4 Import BGP4 Preference) + (Local Pref <= 0x1fff ? 0x1fff - Local Pref : 0) |
| RIP imported | Metric |
| EGP imported | Distance |
| Static | SR cost |

**8. Add the values you have calculated.**

_____

_____

_____

_____

The total is the route weight: _____

# Appendix E
# IP/OSPF Configuration

The IP/OSPF configuration in Figure E-1 shows an AS divided into different types of OSPF areas using several types of OSPF routers and interfaces as well as variable-length subnetting. This appendix describes parameter settings for router 1 through router 6. Routers W through Z and A through D are included on the network map for completion.

In the configuration in Figure E-1:

- The OSPF Area Authentication parameter is set to none for all areas.
- All Timer parameter values are left at their defaults (hello, dead, and poll interval).
- No virtual links are configured.
- Route summarization is not used.
- The frame relay cloud is set to the default management type. It is non-fully meshed with all group mode PVCs.
- There are three area border routers (router 2, router 3, and router 4), two internal backbone routers (router 1 and router 5) and one AS boundary router (router 6 has an Ethernet interface using RIP).
- Router 2 is the designated router for the FDDI segment. Router 4 must be the designated router for the frame relay cloud.
- The unnumbered LAN connecting router 6 and router D is included to ensure that every internal node in area 0.0.0.1 is reachable from every other internal node.

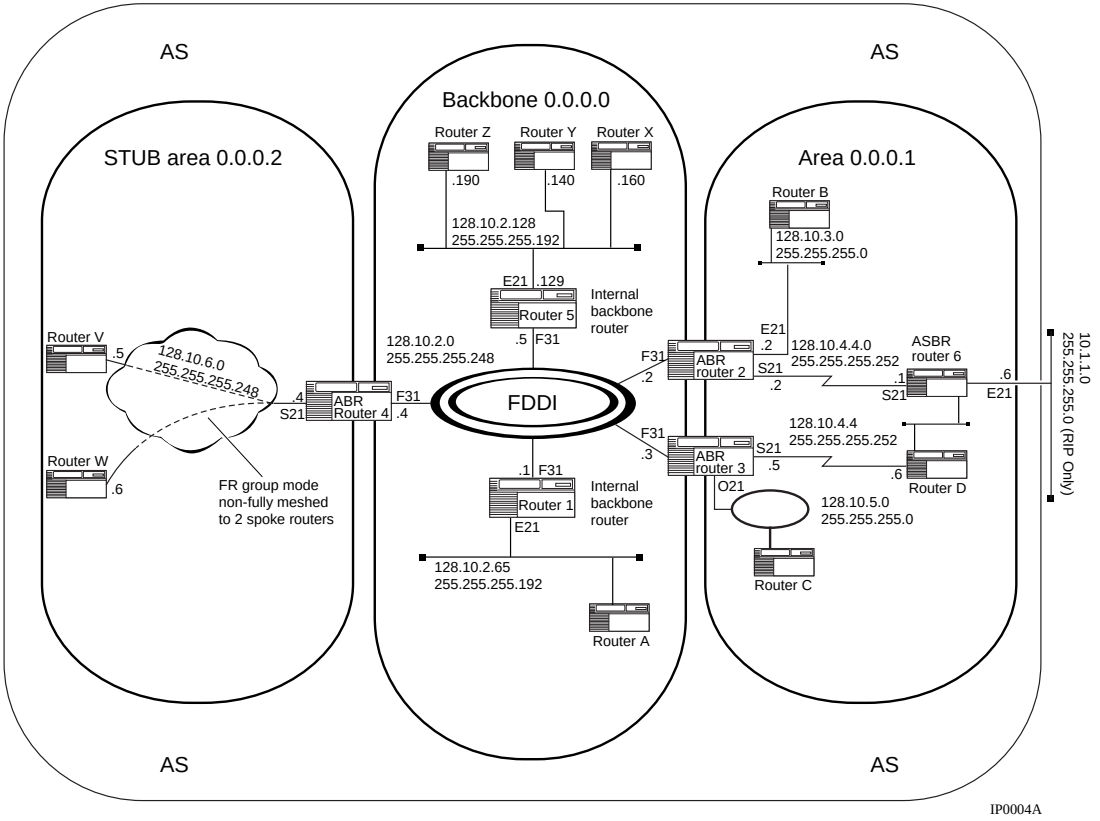


**Figure E-1. IP/OSPF Configuration**

Tables E-1 to E-6 list nondefault configuration parameters for router 1 through router 6. Parameters that are not shown are set at their defaults.

**Table E-1. Internal Backbone Router 1**

| Site Manager Window/Parameter | Setting |
|---|---|
| Interface F31 | |
| IP Configuration/IP Address | 128.10.2.1 |
| IP Configuration/Mask | 255.255.255.248 |
| OSPF Global/Rtr ID | 128.10.2.1 |
| OSPF Area/Area | 0.0.0.0 |
| OSPF Interface/Broadcast Type | Broadcast |
| Interface E21 | |
| IP Configuration/IP Address | 128.10.2.65 |
| IP Configuration/Mask | 255.255.255.192 |
| OSPF Area/Area | 0.0.0.0 |
| OSPF Interface/Broadcast Type | Broadcast |

**Table E-2. Area Border Router 2**

| Site Manager Window/Parameter | Setting |
|---|---|
| Interface F31 | |
| IP Configuration/IP Address | 128.10.2.2 |
| IP Configuration/Mask | 255.255.255.248 |
| OSPF Global/Rtr ID | 128.10.2.2 |
| OSPF Area/Area | 0.0.0.0 |
| OSPF Interface/Broadcast Type | Broadcast |
| OSPF Interface/Rtr Priority | 2 or greater |
| Interface E21 | |
| IP Configuration/IP Address | 128.10.3.2 |
| IP Configuration/Mask | 255.255.255.0 |
| OSPF Area/Area | 0.0.0.1 |
| OSPF Interface/Broadcast Type | Broadcast |
| Interface S21 | |
| WAN Protocol | Standard |
| IP Configuration/IP Address | 128.10.4.2 |
| IP Configuration/Mask | 255.255.255.252 |
| OSPF Area/Area | 0.0.0.1 |
| OSPF Interface/Broadcast Type | Point-to-point |

**Table E-3. Area Border Router 3**

| Site Manager Window/Parameter | Setting |
|---|---|
| Interface F31 | |
| IP Configuration/IP Address | 128.10.2.3 |
| IP Configuration/Mask | 255.255.255.248 |
| OSPF Global/Rtr ID | 128.10.2.3 |
| OSPF Area/Area | 0.0.0.0 |
| OSPF Interface/Broadcast Type | Broadcast |
| Interface O21 | |
| IP Configuration/IP Address | 128.10.5.3 |
| IP Configuration/Mask | 255.255.255.0 |
| OSPF Area/Area | 0.0.0.1 |
| OSPF Interface/Broadcast Type | Broadcast |
| Interface S21 | |
| WAN Protocol | Standard |
| IP Configuration/IP Address | 128.10.4.5 |
| IP Configuration/Mask | 255.255.255.252 |
| OSPF Area/Area | 0.0.0.1 |
| OSPF Interface/Broadcast Type | Point-to-point |

**Table E-4. Area Border Router 4**

| Site Manager Window/Parameter | Setting |
|---|---|
| Interface F31 | |
| IP Configuration/IP Address | 128.10.2.4 |
| IP Configuration/Mask | 255.255.255.248 |
| OSPF Global/Rtr ID | 128.10.2.4 |
| OSPF Area/Area | 0.0.0.0 |
| OSPF Interface/Broadcast Type | Broadcast |
| Interface S21 | |
| WAN Protocol | Frame relay |
| IP Configuration/IP Address | 128.10.6.4 |
| IP Configuration/Mask | 255.255.255.248 |
| OSPF Area/Area | 0.0.0.2 |
| OSPF Area/AS External | No (area 0.0.0.2 is a stub) |
| OSPF Interface/Broadcast Type | Point-to-multipoint standard |

**Note:** Router 4 must be the designated router for the frame relay network within the cloud. To ensure this, set the Router Priority parameter on the OSPF frame relay interfaces for router V and router W to zero. The broadcast type should be set to Point-to-multipoint (standard). In addition, router V and router W must have IP adjacent host entries configured for each other.

**Table E-5. Internal Backbone Router 5**

| Site Manager Window/Parameter | Setting |
|---|---|
| Interface F31 | |
| IP Configuration/IP Address | 128.10.2.5 |
| IP Configuration/Mask | 255.255.255.248 |
| OSPF Global/Rtr ID | 128.10.2.5 |
| OSPF Area/Area | 0.0.0.0 |
| OSPF Interface/Broadcast Type | Broadcast |
| Interface E21 | |
| IP Configuration/IP Address | 128.10.2.129 |
| IP Configuration/Mask | 255.255.255.192 |
| OSPF Area/Area | 0.0.0.0 |
| OSPF Interface/Broadcast Type | Broadcast |

**Table E-6. AS Boundary Router 6**

| Site Manager Window/Parameter | Setting |
|---|---|
| Interface S21 | |
| Wan Protocol | Standard |
| IP Configuration/IP Address | 128.10.4.1 |
| IP Configuration/Mask | 255.255.255.252 |
| OSPF Global/Rtr ID | 128.10.4.1 |
| OSPF Global/<br>AS Boundary Router | Yes |
| OSPF Area/Area | 0.0.0.1 |
| OSPF Interface/Broadcast Type | Point-to-point |
| Interface E21 | |
| Add Protocols | RIP |
| IP Configuration/IP Address | 10.1.1.6 |
| IP Configuration/Mask | 255.255.255.0 |

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